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MISCELLANEOUS OBSERVATIONS

ON

PLANTING, &c.

Juſt publiſhed, and ſold by T. CADELL, London, and C. ELLIOT, Edinburgh, price 2 s. ſewed,

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PRACTICAL DISCOURSE

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MISCELLANEOUS OBSERVATIONS

ON

PLANTING AND TRAINING

TIMBER-TREES;

PARTICULARLY CALCULATED FOR

THE CLIMATE OF SCOTLAND.

In a SERIES of LETTERS.

BY AGRICOLA.

EDINBURGH:

Printed for CHARLES ELLIOT, Edinburgh;
and THOMAS CADELL, London.

M, DCC, LXXVII.

TO

THE RIGHT HONOURABLE

LORD HADDO,

WHOSE FIRST APPEARANCE IN LIFE

GIVES ROOM TO HOPE

THAT THE INFLUENCE HE WILL DERIVE FROM

AN AMPLE FORTUNE

AND

ILLUSTRIOUS BIRTH

WILL BE EXERTED IN PROMOTING THE IMPROVEMENTS

OF

HIS NATIVE COUNTRY;

THE FOLLOWING PAGES

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ADVERTISEMENT.

The following LETTERS *were firſt publiſhed in the* Edinburgh Weekly Amuſement, *and have been reprinted by themſelves, at the Requeſt of ſeveral Perſons eminently diſtinguiſhed for their Knowledge and Public Spirit.*

MISCELLANEOUS OBSERVATIONS ON PLANTING.

LETTER First.

General Obſervations on the great Profit that may be made by judicious Plantations of Timber Trees.

SIR, *Feb.* 28. 1771.

WHILE the great men, who ſurround the throne of our moſt gracious Sovereign, are wrangling about places and penſions, and trying who can prevail in the conteſt for riches

and honours; while *Junius* is ſtudying how he can beſt annoy the men in power, and *North* is putting on his armour for defence; while *Cambden* is turning over the muſty records of antiquity, for precedents of law to confound his antagoniſt, and *Mansfield* is preparing himſelf to meet this doughty champion; while *Chatham* is publiſhing his oracular ſpeeches, to convince the world that he alone is able to penetrate the deſigns, and fruſtrate the attempts of all our enemies; while *Rockingham* calls forth his myrmidons, and *Burke* and *Barre* ſound the dread alarm of war, of bloodſhed, and of total deſolation; let us, who live at a diſtance from theſe tumultuous ſcenes, look up with indifference on all theſe ſeveral conteſts, little ſolicitous about the ſucceſs of either party, being convinced that diſputes of this ſort muſt ever be the neceſſary attendant, and perhaps the ſureſt guard of public liberty; and, while we laugh at the ſpecious pretexts which they employ

employ to impoſe upon each other, let us, without peeviſhneſs, allow them to enjoy, as well as they can, their ſhort-lived glory, and plume themſelves upon their fancied ſuperiority, while we, with diligence and aſſiduity, endeavour, each of us, faithfully to perform that taſk which Providence has allotted us, and, in our more humble ſphere, contribute what is in our power for the public good, by encouraging every uſeful art, and carrying on, with a chearful alacrity, every improvement that can benefit the nation, while, at the ſame time, it promotes the happineſs of individuals. It is with a view to turn the attention of my countrymen to an object of much conſequence to many individuals among us, as well as of the moſt general utility to this antient kingdom, that I give you the trouble of this letter.

The ſcarcity of wood is a general complaint throughout all Britain, eſpecially in Scotland; which is the more to be regret-

ted, as there are ſo many extenſive tracts of land in almoſt every corner of it, entirely proper for raiſing wood, which are at preſent of almoſt no value at all,—the produce being next to nothing. I would therefore ſtrongly recommend this ſubject to the attention of the proprietors of ſuch land, and beg of them ſeriouſly to examine of what importance it might be to themſelves and their heirs, if a ſmall part of theſe barren waſtes was covered with trees; and I am ſatisfied, that a very little reflection will ſoon convince them of the great utility of it.—That any one who turns his attention this way, may not be impoſed upon by falſe reaſoning, I would likewiſe recommend to him to take the opinion of any of his neighbours, who, in the younger part of his life, may have made any conſiderable plantation of trees;—or let him go to any thriving wood, and carry with him a man who is a judge of the value of the trees which are in it, and compute what

may

may be the value of the wood on one acre, and I ſhall not be afraid that he will draw an unfavourable concluſion; although I am ſenſible, that nineteen plantations out of twenty, which have been made in this country, have been executed with ſo little judgement, that the proprietor does not draw near the one half of what he might have done by a more judicious proceeding; as I ſhall probably have occaſion to ſhow hereafter.

I believe many perſons are prevented from planting trees, by thinking that ſuch a great length of time muſt elapſe before they can reap any profit or advantage from them. And indeed trees, like children, advance ſo gradually in their growth, that we do not perceive their encreaſe by looking at themſelves, unleſs we compare them with ſome fixed ſtandard,—which we more ſeldom apply in the one caſe than the other. It would, however, be very eaſy for me to produce, from accurate calculations,

culations, the cleareſt proof, that theſe advance ſo faſt, as that few men, except when on the very verge of old age, have not a reaſonable proſpect of reaping conſiderable advantage from their plantations in their own life-time; but, as I would always wiſh rather to refer to experience than reaſoning, I ſhall here omit theſe calculations, and only beg of the reader to open his eyes, and be attentive, and he cannot fail of meeting with abundant proof of this. If he is acquainted with Eaſt Lothian, I would bid him obſerve the wood of *Tinningham*, from which the Earl of Haddington at preſent draws ſuch a conſiderable revenue, and be informed that this wood was planted by the late Counteſs-dowager of Haddington, after ſhe was become a widow, and well ſtriken in years; yet, notwithſtanding this unfavourable circumſtance, ſhe had the pleaſure, ſeveral years before her death, to ſee this wood, planted at ſuch an advanced period of her life, abundantly

repay

repay to her ſon all the expence and care ſhe had been at; and uſed to boaſt, with a very allowable ſpecies of vanity, that this field, which had come into her poſſeſſion a barren waſte, had, by her management, become one of the moſt valuable that belonged to the family of Haddington.

Many other inſtances of the ſame kind might eaſily be produced, to ſhow the ſpeedy, though imperceptible advance, that trees make in growth: but, to render this ſtill more plain and obvious to the ſenſes, I ſhall here preſent the reader with a table, ſhowing the real encreaſe of twelve trees in ſixteen years, as they were actually meaſured by Mr Robert Marſham, and recorded in the Philoſophical Tranſactions, vol. LI. I muſt, however, obſerve, that I have taken only the two firſt columns from the Table he publiſhed, having altered the others where I found them defective. For, as he has ſuppoſed, that all the trees were of an equal height, and made his

his calculations accordingly, it is obvious they muſt be erroneous; for every one knows that a tree, till it arrives at a very conſiderable ſize, continues to advance in height as well as in girt; ſo that, to make an exact meaſurement of its contents, it is neceſſary to attend to both theſe particulars. To do this in the moſt accurate manner I could, I have aſſumed as *data*, that trees advance in height in the ſame proportion with reſpect to their girt, as is expreſſed in the margin, which the reader may correct, if he thinks they are erroneous; but it will be neceſſary for him to obſerve, that, although when trees turn old, they advance but little in height; yet, as their boughs become large, and afford wood as well as the trunk, theſe ought to be meaſured as well as the body of the tree; ſo that I imagine that the height which I have aſſigned to the largeſt trees,

Girt. Feet.	Height. Feet.
1	10
2	15
3	19
4	23
5	25½
6	27
7	28½
8	29
9	29½
10	30

is

A TABLE, ſhewing the encreaſe of twelve Trees in ſixteen years, from actual Meaſurements taken by Robert Marſham, firſt in April 1743, before they began to grow, and again in Autumn 1758, after that year's growth was complete.

Different ſorts of Trees meaſured.	Girt in 1743			Girt in 1758			Height in 1743	Height in 1758	Solid Con. 1743		Solid Con. 1758		Incr. 16 Y.	
	Feet.	Inch.	Dec.	Feet.	Inch.	Dec.	Feet.	Feet.	Feet.	Cubic	Feet.	Cubic	Feet.	Cubic
I. An Aſh planted ſince the year 1647	9	10	4	11	1	0	29 3/4	30 1/2	172	9	230	6	57	7
II. An Oak paſt thriving, but ſound	9	4	4	10	1	0	29 1/2	30	149	3	190	3	41	0
III. An Oak about 80 years old -	5	3	3	7	8	3	27 1/2	28 3/4	67	5	118	0	50	5
IV. A Scots Fir, ſowed in 1698 -	5	4	6	6	6	0	26	27 3/4	46	2	72	9	26	7
V. An Oak planted about 60 years	5	11	1	7	2	3	26 3/4	28 3/4	57	1	91	9	34	8
VI. A Spaniſh Cheſnut near 60 years old	4	4	0	5	6	3	23 1/2	26 1/4	27	5	51	6	24	1
VII. Another 45 or 46 years old -	2	9	6	4	4	4	18	23 1/2	8	4	27	5	19	1
VIII. An Oak planted by myſelf in 1720	2	11	2	5	1	2	18	23 1/2	9	5	37	9	28	4
IX. A Scots Fir planted in 1634 -	1	11	6	4	0	0	15	23	3	7	23	0	19	5
X. A Pinaſter planted in 1734 or 35	2	5	1	4	3	1	17	23 1/2	6	4	26	5	20	1
XI. An Oak ſowed in 1719 - -	1	7	0	2	8	2	13	18	2	0	7	9	5	9
XII. An Oak planted in 1720 or 21	2	9	5	4	9	4	18	25	8	7	35	2	26	5
Total increaſe in 16 years													353	1

is rather under than above the truth. Having premiſed this much, I ſubjoin the Table, with the corrections, as under.

From this table it appears, that twelve trees have encreaſed three hundred and fifty-three cubic feet in ſixteen years; which, if ſold at one ſhilling *per* cubic foot, would amount to 17 l. 13 s. ſterling. Now, if we ſhould ſuppoſe a Scots acre of ground planted with trees thriving at the ſame rate, at ten feet diſtance from one another, it would contain 540 trees, and would of conſequence yield of encreaſe 15885 cubic feet in ſixteen years; which, if ſold at one ſhilling *per* cubic foot, would amount to ſomething better than 794 l. ſterling; which, divided by ſixteen, gives 49 l. 10 s. for the annual produce: Or, if the wood were ſold at ſixpence *per* cubic foot, it would give 24 l. 15 s. *per annum;* or, if at threepence *per* cubic foot, 12 l. 7 l. 6 d.; or at one penny *per* foot, it would yield 4 l. 2 s. 6 d. *per annum;* which is a profit great enough to ſatisfy the moſt avaricious. And although we ſhould al-

low

low it to be highly probable, that the trees which form the ſubject of this experiment, have been more favourably ſituated, and perhaps advanced faſter than could be expected in a general plantation, we have room to make conſiderable deductions on that account, without diminiſhing the profits near ſo much as moſt people would be ſatisfied with; as even one tenth of the ſmalleſt of theſe calculations is more than is generally drawn for good arable land in many parts of this kingdom.

I ſhall not at preſent trouble you with many remarks upon this Table, as I ſhall only obſerve, that from it we may learn, That although trees encreaſe faſter when young, in proportion to their ſize, yet large trees do really produce more wood in an equal ſpace of time than ſmall ones. Thus No. I. produces, in ſixteen years, 57.7. cubic feet of wood, which is preciſely one fourth of its whole bulk; whereas

No. IX. encreaſes only 19.3. cubic feet, which is three-fourths of the whole bulk nearly. Whether the greater ſpace neceſſary to be allowed to large trees than young, would be ſufficient to counterbalance the greater produce, I cannot exactly ſay; but I am diſpoſed to imagine it would, as we ſee that young trees bear to be much cloſer upon one another than when older; ſo that probably an acre of young growing wood would produce as much as one of full-grown trees in an equal number of years. But whatever may be the caſe with regard to large plantations, it is obvious, that ſuch trees as ſtand ſingle, and are advanced to a conſiderable ſize, continue to encreaſe in quantity very much; ſo that every one who has ſuch trees ought to preſerve them with care, as they are continually gaining more and more, and adding to the ſtock of the proprietor in a much higher degree than any

intereſt

intereſt he could get for the money which he would draw from ſelling them.

It is likewiſe worth remarking, that, of all the trees mentioned in this Table, none of them (except the large thriving Aſh, No. I.) advance ſo faſt as the Oak. I would wiſh that my countrymen would pay a particular attention to this circumſtance; becauſe there ſeems to be a general prejudice among the people of Scotland againſt this noble tree, ſo juſtly termed the *king of the woods;* it being imagined, from its ſlow progreſs at firſt, and the length of time it continues to thrive, that it makes but very little progreſs; but this notion is ſufficiently refuted by experience, as this Table ſhows. It is worth obſerving, that even Mr Marſham himſelf was deceived by this tree; as he had imagined that No. II. was paſt thriving, and yet it encreaſed, in ſixteen years, 41 cubic feet; which, at the ordinary ſelling price of that wood, is worth

worth 4l. ſterling and upwards. I ſhall not now take up more of your time; but may, perhaps, on ſome future occaſion, ſend you ſome further remarks upon this ſubject.

AGRICOLA.

P. S. Since the above was written, I have met with the following facts that ſtrongly confirm the obſervations contained in the foregoing letter, and therefore deſerve the particular attention of the reader.

Mr Arthur Young, in his Eaſtern tour, takes notice of the improvements of Mr Melliſh, in the following terms. "Mr Melliſh has, for many years, raiſed numerous plantations, which are a very great ornament, not to his eſtate only, but to the whole country. In this noble purſuit, he has gained much experience in planting

ing ſandy ſoils eſpecially, from trying various methods, and different ſorts of trees. Some pieces of foreſt-land he has cleared from the ſpontaneous rubbiſh, in the ſame manner as for corn, and ploughed it once in the common manner, upon which he ſet the trees. Others he trench-ploughed, and ſet them; and, upon ſome other pieces, he did not plough at all, and cleared no more than neceſſary to make the holes to plant them in. The reſult of theſe various trials was indeterminate, each nearly equal; but, if any difference, thoſe planted after clearing and ploughing were the beſt. The ſorts tried were Scots and ſpruce firs, larch, oak, aſh, cheſnut, beech, birch, &c. the whole mixed. Scots and ſpruce firs have grown much faſter than any of the reſt, and they have all ſo generally ſucceeded, that ſcarcely one in ten thouſand have failed. The ſoil he has choſen is foreſt-land of 3s. an acre.

The

The number he has generally ſet on an acre is 5000; the expence of incloſing, raiſing the trees, and planting, is 3 l. an acre. In five years they require thinning; the value of the wood taken out about pays for the labour *; the number taken out about 1000.

In five years more they are thinned again, when another thouſand trees are taken out, which make very good hedge-wood and hedge-ſtakes. The value about 5 l. more than what pays the labour.

After theſe thinnings, 3000 are left, which Mr Melliſh has found from experience to be then worth 6 d. each, on an average, as they ſtand, clear of all expences, if ſold. At this time another thouſand ſhould be taken out.

Two thouſand are therefore left, which, at thirty years growth, will be worth, as

* Firs ſhould always be cut in the middle of ſummer, in full turpentine.

they

they ſtand, 1 s. each; and, at forty years, they will be worth 2 s.

This is the ſtate of the planting-produce on the poor foreſt-ſands: but Mr Melliſh has many Scots firs, planted thirty-five years ago on good land, which are now worth 40 s. each, and very many from 25 s. to 35 s.

Upon theſe *data* we may eaſily calculate the profit of planting at different periods.

Account of an acre of Firs at the end of the fifth year.

	l.	*s.*	*d.*
Firſt incloſing *, raiſing, planting, fencing, &c.	3	0	0
Intereſt of the above ſum for five years	0	15	0
Rent	0	15	0
	4	10	0
In Five years more.			
Reparation of the fences	0	5	0
Intereſt of 4 l. 10 s. for five years	1	2	6
Allow for compound intereſt	0	15	0
Rent	0	15	0
	2	17	6
Firſt five	4	10	0

* This price is for a large field of 10, 15, or 20 acres, and not a ſingle acre. It is the proportion of the whole.

				l.	s.	d.
Expence at the end of ten years				7	7	6
Received for thinnings				5	0	0
Excefs				2	7	6

At the end of Twenty years.

Rent				1	10	0
Reparation of fences				0	10	0
Intereft				1	0	0
				3	0	0
Received for 1000, at 6d.				25	0	0
Value of 2000 remaining, at fame rate				50	0	0
				75	0	0
Deduct, as above			3 0 0			
Excefs at the end of five years			2 7 6			
				5	7	6
Clear profit in twenty years				69	12	6
Which is *per* acre *per annum*				3	9	1

But, fuppofing the 2000 trees left ten years longer, the account will ftand as under.

Received for 1000, at 6d.				25	0	0
Deduct, as above				5	7	6
Profit in twenty years, excluſive of trees remaining				19	12	6
Which, *per* acre *per annum*, may be called				1	0	0

At the end of Thirty years.

Rent				1	10	0
Fences				0	10	0
Intereft				1	0	0
				3	0	0

Suppoſing

			l.	*s.*	*d.*
Suppoſing the plantation then cut down, the 2000 trees, at 1 s. bring			100	0	0
Deduct, as above			3	0	0
Profit			97	0	0
Firſt ten years expence			7	7	6
Second ten ditto			3	0	0
Third ditto			3	0	0
Total expence			13	7	6
Received ſecond thinning			5	0	0
Third ditto			25	0	0
The 2000 remaining			100	0	0
Total			130	0	0
Expences			13	7	6
Clear profit in thirty years			116	12	0
Or *per* acre *per annum*			3	17	1
At the end of Forty years.					
Expences as before			3	0	0
Received for 2000 trees, at 2 s.			200	0	0
Ditto, firſt and ſecond thinnings			30	0	0
Total			230	0	0
Deduct expences, as before	13 7 6				
Ditto	3 0 0				
			16	7	6
Clear profit in forty years			213	12	6
Or *per* acre *per annum*			5	6	1

This account of the expences, produce, and profit, of planting foreſt-land, at 3 s. an acre, ſhews the amazing profit of ſuch undertakings. Plantations have, in general, been raiſed with a view merely to beauty, or elſe through a very noble patriotic motive of being ſerviceable to the country; but it is evident that they may be undertaken with very different views: with thoſe of profit. So that a man may cut down the trees he planted himſelf, and expect to reap, in ſo doing, very conſiderable profit.

If he cuts all down at the end of twenty years, and leaves not a ſingle tree, he gains a profit clear of near 70 l. an acre, which is 3 l. 9 s. *per* acre *per annum* from the firſt planting. Let me aſk the moſt ſkilful farmers of this country, how they will exceed ſuch a profit, by any ſyſtem of common huſbandry, on ſuch poor land? It before appeared, that common good huſbandry,

bandry, after ſome improvements, would yield but 1 l. 1 s. 11 d. *per* acre profit; ſo that the planting, to cut in twenty years, is more than thrice as beneficial, and certainly much leſs expoſed to accidental loſſes.

But ſuppoſing the trees left thirty years, in that caſe the thinnings pay, for the firſt twenty years, 1 l. *per* acre *per annum;* and, at the end of the thirtieth, the account from the firſt planting is 3 l. 17 s. 1 d. *per* acre; and, in forty years, 5l. 6s. 1d. After which time they may be ſuppoſed to decline in quickneſs of growth, and conſequently had better be cut down in point of profit.

If beauty of ſituation is not, in ſome reſpects, commanded, we ſeldom ſee plantations of quick-growing trees; but it is evident that poor ſoils ſhould be planted upon the mere view of profit: a crop of firs, inſtead of a crop of wheat, barley, or oats,

oats, at twenty years growth, which ſo many men may expect to ſee out in perfection, will turn out far ſuperior. One of the moſt profitable farms would be a thirty years leaſe of ſuch land, with liberty to plant and cut down. One of twenty years, which is a ſhorter period than the generality of long leaſes, would, thus applied, exceed common huſbandry on ſuch ſoils."

Theſe are not the only ſucceſsful experiments on planting recorded by that rural traveller. In recording the experiments of Sir John Turner (of Warnford in Norfolk), he takes notice,

Experiment, No. 7.

That " Sir John Turner has not only planted many acres as an addition to the beauty of his ſituation, but has alſo attended to the growth of the trees, for diſcovering

covering the profit of planting on his ſoils. In one plantation, Scots firs, at 12 years growth, are worth 1 s. each.

Experiment, No. 8.

In a plantation of 50 years growth, the land 8 s. an acre, the trees are various, and the value as follows:

Oak, worth 10 s. each.
Aſh, 12 s. 6 d. ditto.
Elm, 10 s. ditto.
Scots fir, 7 s. 6 d. ditto.
Lime, 5 s. ditto.

Suppoſe the number of each equal, the average value is 9 s. The number about 500 on an acre.

Five hundred trees, at 9 s. are 225 l. or 4 l. 10 s. *per* acre *per annum*, from the firſt planting; but the thinnings have produced very conſiderable ſums: and the graſs under the trees would now let at 5 s. an acre.

Experiment,

Experiment, No. 9.

In another plantation of 50 years growth, on land of 8 s. an acre, the trees, 250 *per* acre, are worth—

The oak, 16 s. each.

Aſh, 10 s. ditto.

Lime, 9 s. ditto.

Scots fir, 16 s. ditto.

Average, 12 s. 9 d.

Two hundred and fifty at that price come to 154 l. 7 s. 6 d. *per* acre, beſides the thinnings: this is above 3 l. *per* acre *per annum* from the firſt planting.

Had all been oak or fir, the total would have been 200 l. *per* acre, or 4 l. *per* acre *per annum* from the firſt planting.

Experiment, No. 10.

In another plantation, elms of 40 years growth (300 on an acre), are worth 22 s. each; this is 330 l. *per* acre, or more than 8 l. *per* acre *per annum;* and the land

now

now would let as well as before the planting.

Experiment, No. 11.

A plantation of Scots firs, of 15 years growth, 300 on an acre, are worth 1 s. 6d. each. This is 22 l. 10 s. an acre, or 1 l. 10 s. *per* acre *per annum*, beſides thinnings.

The great profit of planting is obvious from theſe trials; but the whole ſtate of the caſe by no means appears here; for the product of the thinnings is conſiderable. Sir John calculates, that he never receives leſs than a guinea an acre in thinnings throughout his plantations; which is eaſily to be conceived, as they are at firſt planted only four feet aſunder.—The loweſt profit here mentioned is 1 l. 10 s. an acre; add 1 l. 1 s. for thinnings, it is 2 l. 11 s. *per* acre; deduct 11 s. rent and expences, there remains 40 s. an acre clear profit; which is more than the farmers

make by all their trouble, induſtry, and hazard."

And again, in recording the experiments of William Fellowes, Eſq; of Shotteſham, he gives the following account of his plantations.

" Mr Fellowes has given yet greater attention to planting than to huſbandry, and has tried various trees ſome years ago; ſo that he is now able clearly to judge which is the moſt profitable.

Experiment, No. 9.

A plantation of Scots firs, of 45 years growth, 20 feet ſquare, on land of 15 s. an acre, are now worth 20 s. each on an average. At that diſtance there are 108 trees on an acre, or 1081.; which is 2 l. 9 s. *per* acre *per annum* from the firſt planting, excluſive of thinnings, which would more than double it. But the graſs under

der the trees would have let, for many years paſt, at 7s. an acre.

Experiment, No. 10.

Another plantation of Scots firs, 38 years growth, ſtanding in rows 14 feet wide, and 10 in the row, are now worth 10s. on an average. This diſtance gives 300 on an acre; and, at 12s. come to 180l. or 4l. 14s. *per* acre *per annum*, beſides thinnings. The rent of the land 15s.; poor-rates, 1s. 3d. in the pound; and tythe, till 20 years old, 5s. an acre; the graſs under them now 5s. an acre. It is ſufficiently evident that no huſbandry can equal this.

Experiment, No. 11.

Cheſnuts, in 38 years, on the ſame land, ſtanding 14 feet by 10, are worth 15s. each. This is 225l. *per* acre, or 5l. 16s. *per* acre *per annum*, beſides thinnings.

Experiment, No. 12.

Scots firs, in 38 years, on the ſame land, meaſure 17 feet of timber on an average, for which Mr Fellowes has been offered 11 d. a-foot; that is, 15 s. 7 d. a tree. They ſtand 14 feet by 10. An acre would therefore be 233 l. 15 s. or 6 l. 3 s. *per* acre *per annum*, beſides thinnings. Theſe trees are 60 feet high.

Experiment, No. 13.

On the ſame land larch-trees, of only 31 years growth, are as large as the firs of experiment, No. 12. which ſhews that the larch is a much quicker grower. Spruce by them, not ſo large as either. The pinaſter of 38 years, larger than the Scots: the cedar of Lebanon, of the ſame age, would now cut into planks 12 inches wide.

Experiment, No. 14.

A very ſtriking compariſon between the larch

larch and the ſpruce-fir was tried by planting an old gravel-pit levelled, ſurrounded by a plantation of Scots firs, with thoſe two ſorts in alternate rows: The larch is from 6 to 12 feet high; whereas the ſpruce is but 2 feet on an average.

Experiment, No. 15.

A large plantation of many acres of a poor gravelly land, at 8s. an acre, containing Scots and ſpruce-firs and larches, is now 16 years old; they are in ſquares of 10 feet, and are worth—

The Scots, 2s. 6d. each.

The ſpruce, 3s. 6d. each.

The larches, 4s. 6d.

At ten feet, there are 435 trees on an acre.

The Scots, at 2s. 6d. come to 54l. 7s. 6d.; or *per* acre *per annum*, 3l. 7s.

The ſpruce, at 3s. 6d. to 76l. 2s. 6d. or *per* acre *per annum*, to 4l. 15s.

The

The larch, at 4s. 6d. to 97l. 17s. 6d.; or *per annum*, 6l. 2s.

All theſe excluſive of thinnings.

Suppoſe we calculate theſe at no more than paying the rent, tythe, and town-charges, and that the larch, in 20 years, come only to 100l. which is, however, under the truth; let any one calculate the profit of hiring land on a twenty-one (or more) years leaſe, and immediately planting. In what other application of the land can ſuch great profit be made, as gaining 6l. an acre without any riſk, and almoſt without any expence? It is true, ſuch a conduct cannot, like the culture of corn and graſs, be general, for reaſons obvious to every one; but, as far as the whole demand of any neighbourhood extends, it is profitable to execute it. Such a demand is every-where very great, for the uſe of rails, ſpars, beams, board, planks, &c. &c. according to the age of the

the trees; and great quantities of theſe are perpetually importing from the Baltic. So far, therefore, as the demand extends, it is highly adviſeable to plant theſe trees.

Suppoſe five acres of larch planted every year; at the end of 16 or 17 years, five acres will every year be cut down, of the value of 500 l.; from that day a regular product of 500 l. a-year is gained from the application of 100 acres of land. Let to a tenant, theſe 100 acres produce 40 l. a-year; but planted, they produce 580 l. a-year. What an amazing difference!

Suppoſe a ſingle acre planted every year, after the expiration of 18 or 20, to cut annually 100 l. a-year from only 20 acres, which let, would yield but 8 l. a-year. How beneficial a conduct!

It ſhould here be obſerved, that the larch is valued the ſame as the Scots fir; but the beſt authorities tell us, the timber

is

is one of the moſt uſeful yet known; probably, therefore, the value of it would turn out greater than the ſuppoſition in theſe experiments.

Experiment, No. 16.

Sixteen Scots firs and two pinaſters raiſed from ſeed, ſown between Michaelmas 1732 and Lady-day 1733, were meaſured June 7. 1768. The meaſure is excluſive of the bark, for which 6 feet *per* load was allowed; the bark being very thick, they were valued at 9 d. a-foot, they being full of ſap. The 306 feet come to 11 l. 9 s. 6 d. The trees ſtand in a row at unequal diſtances; but are on an average at 15 feet.

No. 1.	Scots fir	22 feet.
2.	Ditto	13
3.	Ditto	21
4.	Ditto	26
5.	Ditto	9
6.	Ditto	22
7.	Ditto	16
8.	Ditto	10
9.	Ditto	22
10.	Ditto	18
11.	Ditto	15
12.	Ditto	22
13.	Ditto	22
14.	Ditto	8
15.	Ditto	18
16.	Ditto	16
17.	Pinaſter	11
18.	Ditto	15
		306

A beech ſown at the ſame time, meaſured, on January 21. 1769, 19 feet 7 inches.

Mr Fellowes has had both the boughs and ſeed of the red deal from Norway, and he finds that it is the Scots fir.

In a regular planting and cutting down a given quantity of land, it would be adviſeable, I ſhould apprehend, to plant the old land again, which would ſave grubbing

up the ſtumps and roots, which, in rotting, would turn to a rich manure for the new trees.

Plane-trees Mr Fellowes has planted; and he finds them to thrive amazingly in low moiſt ſituations. It will in ſuch grow much faſter than the poplar. One he has of 30 years growth, that will cut into planks 20 inches broad; but ſo vaſt a ſize he attributes, in ſome meaſure, to its ſtanding on the edge of a ditch through which the drainings of a farmer's pig-ſties run. Poplars, in ſome parts of the kingdom, are planted in low ſituations, to the excluſion of every thing elſe: it is of conſequence, therefore, to know that the plane will do better; and in beauty it infinitely exceeds that ragged, crooked, unſightly tree, the poplar.

Mr Fellowes in general recommends the larch as preferable to every other tree that he has tried; and which will pay a planter much

much greater profit than any of the reſt. As to the method of cultivating them, or any firs, he is of opinion that the land ſhould be cropped with turnips, and the trees ſet about the 10th of April following; but, if that ſeaſon is omitted, late in Auguſt will do. They ſhould be 2 years old, and ſet at 4 feet ſquare. For four years it will be adviſeable to hand-hoe the land about them twice a-year, which will coſt 3 s. each hoeing; after that there will be no further expence."

To theſe may be added the experiments of Mr Arbuthnot on planting the black poplar and willow.

" Nine years ago (ſays Mr Arbuthnot) I planted ſome black poplars, eight feet aſunder; the ſize about 1½ inch diameter: meaſured two of them. No. 1. the beſt, contains 13 feet of timber, which would

ſell at 10 d. a-foot, and the forks in the top would give three rails, worth, with the faggots, 2 s. In all 12 s. 10 d.

No. 2. the worſt, 12½ feet of timber, and the top worth 1 s. In all 10 s. 5 d. Average, 11 s. 7 d.

An acre, planted in ſquares of 8 feet, would contain 680 trees, which, at 11 s. amount to	£.	393	0 0

Expences.

Suppoſe the trees bought or raiſed at 3 d. each	8	10	0
Planting	0	5	0
Filling vacancies by death; ſuppoſe 50	0	12	6
Fencing repairs	0	10	0
Nine years rent, ſuppoſe at 30 s.	13	10	0
Total	23	7	6
Product	393	0	0
Expences	23	7	6
Profit	369	12	6
Which is *per* acre *per annum*	41	1	4

No huſbandry or gardening in the world will equal this vaſt profit. It is aſtoniſhing that more plantations of ſuch quick-growing trees are not made. This ſoil is black, rich, low ground, near water.

Experiment,

Experiment, No. 3.

Some willows, planted at the ſame time and diſtance, meaſured, on an average, 18 feet of timber, worth 6 d. a-foot, and the tops 1 s. 6 d.

		£.		
680, at 10 s. 6 d.		357	0	0
Expences as before	-	23	7	6
Profit - -		333	12	6
Or *per* acre *per annum*		37	1	4

From which moſt conſiderable return, there is no ſlight reaſon to ſuppoſe the common idea, that this tree ſhould, for profit, have the head cut off, is an error; for it is a queſtion whether the product by faggots would equal half this; but, in ſituations where poles ſell well, Mr Arbuthnot obſerves, that you may cut them every ſix years, and ſell at an amazing price, but not for faggots. He likewiſe remarks, that the body of the willow-tree rives into pales,

pales, which are admirable for fences, hardening in the air, and are nearly as durable as oak."

To theſe I ſhall only ſubjoin the following experiment on the culture of aſh-trees by the ingenious Mr Boutcher of Comely-gardens.

" I ſhall (ſays he) diſmiſs this uſeful, though not ornamental tree (the aſh), in mentioning an experiment I made very early in life of its value, by planting a ſpecimen of them in copſe, intended principally to ſupply myſelf with poles for eſpalier hedges, and ſtakes for dead fences; for which purpoſes no wood is more proper or laſting.

For theſe ends, in very obſtinate heavy meadow-ground, compoſed chiefly of ſteril red clay and moſs, I planted a rood, or the eighth part of an acre, with aſh-trees

ſix

ſix years old, and about eight feet high. I placed them in rows, four feet aſunder, and two feet diſtance in the row, where I let them remain untouched, only digging the ground about them every autumn, for four years, when I cut them over five or ſix inches above ground for the purpoſe meant, which they then fully anſwered, reſerving twenty of the faireſt plants, at proper diſtances, for trees.

I continued to dig the ground two years longer, and then left them to nature for five years more, that is, ſeven from their being cut down. Having more of them than anſwered my own purpoſes, or indeed than I could have imagined ſo ſmall a ſpot of ground would produce, I thought of making the moſt of what I had to ſpare, and accordingly meaſured off exactly one half of them, which I ſold for pollards and hoops, at 40s.

I cut them again in ſix years more, which,

which, being ſtronger than the former, I ſold for 50 s.

In ſix years after this, I again cut them over, and though theſe were much the largeſt ſhoots, I ſold them at the ſame price as the laſt.

There remained now twenty trees in the whole ground, intended to ſtand for timber, ten of which grew amongſt the copſe I had ſold. My meaning was, not to touch theſe till the decline of my life, that I might leave to poſterity what obſervations I was able to make, of the profit a man who begins to plant when young, may reap from it in his own time. But the croſs events of life diſappointed me; for becoming ſecurity in conſiderable ſums for others, who failed in their affairs, I was obliged, by rigid creditors, to ſell my land, at which time my neceſſities alſo conſtrained me to ſell my trees of all kinds. I hope the reader will excuſe this digreſſion,

ſion, which I believed neceſſary, to remove the juſt reflection every judicious planter would make againſt me, for cutting down hopeful trees at ſo early and unprofitable a period, if I could have avoided it. Thoſe trees I ſold, of twenty-three years growth, at 7s. a tree to a cartwright, which was 3l. 10s. for the ten trees on the copſe-ground I had cut and ſold three times before.

Thus it appears, that an acre of indifferent ground, (for mine was very bad), planted with aſh-trees in the manner deſcribed, near, or eaſily carried to any popolous town, will yield in twenty-three years time 168l. *, without any other expence

* In the text Mr Boutcher has here only 115l. 10s.; which muſt be evidently a miſtake: for from the foregoing data it appears, that one ſixteenth of an acre yielded,

At the firſt cutting, four years after planting, nothing charged -	£.	0	0 0
At the ſecond cutting, in ſeven years more		2	0 0
Carried over	£.	2	0 0

expence than digging the ground for the firſt five or ſix years, and cutting over the copſe, which is very trifling; and which the owner ought, in all events, to do himſelf carefully, for his own ſake: Let them be cut, ſlanting, with ſharp inſtruments, leaving all the wounds ſmooth and clean, to prevent the wet from lodging in the ſtocks, from whence it might communicate to the roots, and contaminate the whole plant, and which a common purchaſer of the copſe would probably pay little attention to. The beſt ſeaſon for this work is the month of Febru-

Brought forward -	£.	2	0 0
At the third cutting, in ſix years more		2	10 0
At the fourth cutting, in ſix years more		2	10 0
For the ten trees at this laſt period		3	10 0
Total in twenty-three years	£.	10	10 0
Which, multiplied by 16, is		168	0 0

or 7 l. 6 s. 3 d. *per annum*, without reckoning any thing for the firſt cutting, or for the graſs on the field for the whole time.

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ary, before the ſap begin to riſe. I have not mentioned any price for the firſt cutting, having uſed them myſelf. Theſe were planted at eight feet high, and had ſtood for four years from planting; ſo that, from the loweſt calculation, they muſt have been worth more than pay the whole expence of labour: To which I muſt add, that, after ſelling the laſt cutting of my copſe, I was informed by an honeſt man, a good judge of the value of that commodity, that I had been groſsly deceived by the purchaſer, and that I ſhould have received one third part at leaſt more money than I did.

It is neceſſary to obſerve, for the benefit of ſuch as may incline to follow this practice, which is ſurely worth attending to, as it might ſoon become a very profitable improvement, that, after the ſecond cutting, I found I had planted my copſe too thick, and that, had they been at greater

diſtances, I ſhould have reaped conſiderably more advantage from them: I therefore now, from experience, adviſe them to be planted in rows, ſix feet aſunder, and three feet in the row."

From theſe ſucceſsful experiments it will appear evident, that greater profit may accrue to the man who plants trees in a favourable ſituation, even in his own lifetime, than from almoſt any other crop whatever: and if we conſider that theſe will often thrive beſt on ſuch ſoils, and in ſuch ſituations as do not admit of culture, theſe profits will appear ſtill more conſiderable.

I would be far, however, from inſinuating that profits equal to what is recorded in theſe experiments, may be reaſonably expected by thoſe in general who are poſſeſſed of barren and unprofitable ſoils. In an open country, and expoſed ſituation, whatever

whatever be the nature of the ſoil, trees advance much more ſlowly than in a place that is well ſheltered; and it is probable that every one of the places where theſe experiments were made, enjoyed this advantage in an eminent degree, when compared with thoſe bleak ſituations in many parts of Scotland, where no buſh or tree is to be found to give the ſmalleſt interruption to the current of the air, which, in theſe ſituations, ſweeps along the ſurface of the earth with almoſt irreſiſtible fury, and does not permit a tree to live at all, unleſs protected with the greateſt care. Let not thoſe whoſe ſituation in any meaſure reſembles this, hope to have any ſucceſs in rearing trees in the manner mentioned in any of theſe experiments, for they would certainly be diſappointed.

Nor will the profit in many places be nearly equal to what is recorded in theſe experiments, even if the trees ſhould thrive

equally

equally well as theſe did. For the value of wood varies ſo much by the demand that is for it on the ſpot, that in moſt ſituations the ſame quantity of timber would not be a fourth part of what it is valued at above; and in ſome places it could hardly be, *as wood*, valued at any thing at all. Let the ſanguine improver attend to this circumſtance.

But while I would thus caution the young and inexperienced from *raſhly* engaging in extenſive improvements of this ſort, from the hopes of realiſing thoſe golden dreams that may be ſuggeſted by the foregoing experiments, I would wiſh to recommend, in the ſtrongeſt manner I can, to every land-owner to beſtow a proper attention on this ſubject; as I know of no ſpecies of improvement that will with ſo much certainty repay his expence and care, as this will do, when his plantations are made with judgment and diſcretion. It

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is with a view to aſſiſt him in this ſtudy that the following letters were written; and it is hoped, that, by a due attention to what is contained in them, many of thoſe errors may be avoided, which have made numerous plantations of trees miſcarry in different parts of the country, and ſuch circumſtances be pointed out as may render a large plantation of great value to the owner, even in ſituations where the wood itſelf can be accounted as nothing.

LETTER

LETTER SECOND.

Of the Neceſſity of Shelter for Trees;—proper Method of planting in an expoſed Situation.

SIR, *May* 2. 1771.

ACCORDING to my promiſe, I now ſend you ſome further obſervations on planting and the growth of trees, chiefly collected from my own experience and attentive obſervation, wiſhing they may prove of as much general utility as the importance of the ſubject deſerves.

Nothing is in general ſo prejudicial to trees as wind, which, by looſening the roots and bending the tender branches, ſtints them in their growth,—keeps them low and ſtubby, and ſometimes even kills them altogether. For this reaſon we find, that no ſituation is in general ſo favourable for the growth of trees in the country,

try, as the banks of rivers and hollow *dells* between mountains, where, by the form of the ground, they are effectually ſecured from every ſtorm, and ſheltered from every tempeſtuous blaſt; but in more expoſed ſituations, we are under the neceſſity of effecting by art what nature has denied; and, if we would wiſh our trees to thrive, muſt fall upon ſome method of protecting them, when young and tender, from the fury of tempeſtuous winds, otherwiſe they muſt inevitably languiſh, if not periſh entirely.

The beſt method which we have as yet diſcovered for effecting this purpoſe, is to make our plantations of conſiderable extent, where the expoſure is bleak, and to plant the trees at firſt extremely cloſe together, that ſo they may mutually ſhelter one another from the violence of the wind; and as the trees advance ſo as to require a greater ſpace, let the weakeſt

trees be gradually cut down, to leave room for thoſe which are in a more thriving condition; by which means they will be made to advance almoſt as quickly as thoſe which are planted in a more favourable ſituation. But nothing can be more abſurd than to make a plantation of trees, in an open expoſed ſituation, at the ſame diſtance from one another as the trees would require when they ſhould have attained their full ſize;—or to plant a few ſtraggling trees at a diſtance from one another, and unprotected by any neighbouring object; as the wind will there have ſuch an impreſſion upon each, at all times, and from whatever quarter it blows, that they will never be able to make any conſiderable progreſs. We might almoſt as ſoon expect to ſee a tree advance with vigour in the midſt of a bog or a ſalt-water lake, as to ſee one which is planted alone in a very expoſed ſituation,

continue

continue in health and vigour. Let not any one, therefore, who may chance to live in a corner of the country where wood is very ſcarce, and where the few ſtraggling trees that may be in it are poor and ſtinted, too ſuddenly deſpair,—or haſtily conclude, that heaven has denied him the power of enjoying this comfortable bleſſing, till he has thoroughly examined this circumſtance; and if he will take the trouble to examine, with his own eyes, other places ſituated like his own, and truſt to the evidence which this will produce, he will ſoon diſcover, that the reaſons which influence the *great* and the *little* vulgar are fallacious, and are contradicted by ſuch numberleſs examples, that they can only be conſidered as ill-grounded prejudices, which he, by a careful attention, may be ſoon able to deſtroy. This I ſpeak with the greater confidence, as it is the reſult of my own

experience: for I myſelf was exactly in the ſituation here deſcribed, and have now the pleaſure of ſeeing around me as healthy trees as any one could poſſibly deſire; and perhaps the reader will be convinced of this, when I aſſure him, that I have meaſured one year's growth of an oak upwards of five feet in length, which grew in a country where, twenty years ago, they would have believed, almoſt as eaſily, that you might have reared *pine-apples* in the open air, as to have made that tree advance *one* foot in a ſeaſon.

But although all trees require to be ſheltered from the moſt impetuous blaſts, before they can be reared in the utmoſt perfection, yet they differ very much from one another in the degree of ſhelter that they require; ſome being able to thrive in a ſituation where others would totally periſh. Of all the trees that I am well acquainted with, the *aſh*, the *elm* and the

rawn

rawn tree (the *mountain aſh*) are leaſt hurt by open expoſure, and therefore thrive beſt when planted alone or in ſingle rows; and few of our hardy *deciduous* trees are leſs able to endure an expoſed ſituation than the *oak* when young; which is probably one reaſon why this laſt is in ſo little eſtimation in this country, and the others ſo generally cultivated; although it muſt likewiſe be acknowledged, that the two firſt are deſervedly much eſteemed, not only becauſe they can be reared in almoſt any ſituation, but alſo on account of the valuable qualities of their wood, which is perhaps better adapted to the various purpoſes of the huſbandman than even the ſturdy oak itſelf. All the *coniferous* trees are abſolutely incapable of *living* in an unſheltered ſituation; eſpecially the common *pine*, called *Scots fir*, which can hardly *live*, far leſs *thrive*, when planted either in ſingle rows, or thinly ſcattered, unleſs

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in a very ſheltered ſituation; which is the reaſon why we ſo frequently meet with a few ſtinted trees of this kind in different parts of the country, and is likewiſe the cauſe of theſe trees ſo quickly falling to decay, after they begin to be thinned in large plantations; no wood whatever receiving ſo little benefit from the admiſſion of freſh air as this does. But as few trees advance faſter when young, in large plantations, and as none afford a better ſhelter by their numerous branches continually covered with leaves, they are extremely proper for performing the part of nurſes to other more valuable trees, when we want to rear them in a ſituation which is very much expoſed; for under the ſhelter of theſe, almoſt any other tree may be reared to perfection. But, for the reaſons already given, as well as the ſmall value of the wood, they ought ſeldom to be planted as a principal crop; eſpecially as they have this further

ther inconvenience attending them, that when they are once cut down they never ſpring up anew; ſo that the place where theſe have been, is in a ſhort time left as bare as it was at firſt, unleſs a new plantation is made, which is always troubleſome and expenſive. This inconvenience ought, therefore, to be guarded againſt with care; which may beſt be done by planting other trees along with theſe *firs* or *pines*; for as almoſt all other kinds of trees ſend up vigorous ſhoots from the ſtumps as ſoon as the old trees are cut over; if they are once eſtabliſhed, they may be continued for ever; the plantation being renewed every time that the trees are cut down.

For theſe reaſons, in general, the beſt method of making a large plantation of trees, is firſt to fill the whole field very thick with *firs* or other *coniferous* trees, and among theſe plant other more valuable

able kinds of wood; the proprietor being directed in the choice of the kinds by the nature of the ſoil,—his own taſte, and the particular circumſtances of his ſituation. But it ought to be a general rule to plant many different ſorts of trees, that thus there may be a probability of not miſſing that particular kind which is beſt adapted to the nature of the ſoil: For as trees draw their nouriſhment from a great depth, their growth is much influenced by the nature of the under ſtrata, which we have no means of obſerving with accuracy;—nor are we as yet ſufficiently acquainted with the nature and œconomy of the different ſorts of trees to be able to ſay with preciſion which kind would thrive beſt on any given ſoil, even if the ſeveral ſtrata contained in it were clearly ſeen: on theſe accounts we have no ſuch certain method as this is of diſcovering which kind of trees will thrive beſt upon any particular

ſpot,

ſpot, as in theſe circumſtances they will ſoon diſcover themſelves by their ſuperior vigour and healthineſs. And although it is allowable for every one to make choice of that kind of tree which ſuits his own fancy beſt, if all other circumſtances are equal, yet no one ought to be ſo much attached to his own opinion in this reſpect, as to reject others where nature has refuſed to gratify his deſire; for it ought ever to be remembered, that a healthy and vigorous tree, even of an inferior kind of wood, is not only more beautiful, but alſo more valuable, than the very beſt kind of wood when in a languiſhing condition.

If a plantation is made in this manner, the *firs* will ruſh up with vigour, and effectually ſcreen the other trees from every blaſt; but in a few years it will be neceſſary to thin theſe a little, to make room for the other trees as they advance; and as the young trees which are cut out may

in moſt places be ſold to very good account, the proprietor will from this period begin to draw a conſtant annual profit from his wood, which will continue to encreaſe every year as the wood encreaſes, till the whole of the *firs* are cut down; and if the plantation is then divided into a certain number of lots, (more or leſs numerous, according to the demand that the owner finds for old or young wood), one of which may be felled each year, which being preſerved from cattle, will quickly ſpring up again, ſo that by the time he comes back to the lot he began with, it will be ready to be cut again; and in this manner he may continue to go over it again and again for ever, as is practiſed in the wood of Sonien, near the city of Bruſſels in the Netherlands, which yields an annual revenue of more than 6,500 l. ſterling *, and has done ſo without interruption

* I wrote this upon the authority of *Guicciardin*, in his deſcription

tion for many hundreds of years, and may continue to do ſo for ever, if it is managed with proper attention and care.

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deſcription of the Low Countries. His words are theſe. " *Sonien e in Brabante, vicino a Bruſſelles a un' tiro d'artiglieria, et ſi diſtende verſo il mezzo di, in ſino a Briene Alleud, et a Briene le Chaſteau per iſpatio di tre leghe; boſco veramente grande et magnifico, in tanto che contiene di circuity piu di ſette leghe, cio e otto mila bonieri di terra; ciaſcun' boniere contiene quattrocento miſure, et ogni miſura venti piedi Romani; et ſecondo l'ordinario et uſo del paeſe, ſe ne taglia ogn'anno per cento bonieri, che rendono al re intorno a cinquanta mila ſtorini, cio e venti cinque mila ſcudi l'anno; et coſi in capo a ottanta anni, il boſco vien' tutto tagliato, recreſciuto, et rennovato come prima, con grandiſſimi et groſſiſſimi alberi d'ogni ſorte.* Deſcri. delle paeſi Baſſi. p. 33." Which in Engliſh runs thus. " Sonien is in Brabant, about the diſtance of a cannon-ſhot from Bruſſels, and ſtretches towards the ſouth, as far as to Briene Alleud, and Briene le Chateau, for the ſpace of three leagues. This is a wood really great and magnificent, ſo that its circumference comprehends more than ſeven leagues, that is, eight thouſand bonieres of land; every boniere contains four hundred meaſures, and every meaſure twenty Roman feet; and, according to the uſe and cuſtom of the country, there is an hundred bonieres of this wood cut every year, which brings

I ſhall not add further to the length of this letter, but juſt to obſerve, that if any one ſhall find it moſt convenient to cut his wood by way of *copſe*, once in fifteen or twenty years, it will always be proper to leave a few of the moſt thriving trees at conſiderable diſtances from one another, for large timber, and in general the *oak* will be the moſt proper for this purpoſe; for although no tree does worſe to be left thin when very young, yet when it

in an yearly revenue to the king of about fifty thouſand florins, or twenty-five thouſand crowns; and hereby, at the end of eighty years, the wood is cut, grown again, and renewed as at firſt, with very tall and great trees of all ſorts."

I have computed the Roman *ſcudo* to be worth about 5s. 1d. ſterling; ſo that the 25,000 *ſcudi* will amount to ſomething more than 6,350l. ſterling. This calculation was made about two hundred years ago, before the wealth of the Indies had circulated through Europe, and reduced the value of money; ſo that this 6,350l. may be reaſonably ſuppoſed to have been at that time equal to near three times that ſum at preſent; from which computation, inſtead of having ſaid in the text 6,500l. I would have been much nearer the truth to have called it 18,000l. ſterling.

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has arrived at any conſiderable ſize, it reſiſts the tempeſts, and continues to thrive in this ſituation beyond almoſt any other tree. And as this is a wood of ſuch value when full-grown, and of ſuch eſſential ſervice for the royal navy, it ought on no account to be neglected or deſpiſed.

AGRICOLA.

LETTER

LETTER THIRD.

Obſervations on the Fir-tree, *and its Varieties. The Nature of the Soil beſt adapted for rearing theſe.*

SIR,

IN my laſt I recommended the *fir* as the moſt proper tree for thickening plantations, with a view to ſhelter other trees from the hurtful effects of wind: but it is proper here to obſerve, that the kind commonly called *Scots fir*, does not proſper on every ſoil, and therefore cannot be recommended on all occaſions.

The ſoil in which this tree thrives beſt is a dry ſand or gravel, and it never proſpers

ſpers upon a ſtiff clay; nor can it be kept alive in any ſituation where the roots are much expoſed to moiſture of any kind, which is the cauſe of that languiſhing ſtate in which we ſee ſo many plantations of this kind of trees; eſpecially upon flat ground, where the bottom has any tendency to clay. For as theſe plantations are uſually made upon barren and uncultivated ſpots, where there are many ſmall inequalities, which prevent the water from running off with freedom, and the clay below not ſuffering it to percolate through the ſoil with facility, it is there detained, and produces upon the ſurface a light ſpungy kind of ſoil, always ſoft and moiſt, upon which this kind of trees do never proſper; but as there are many different degrees of this evil, the trees are ſeen in as many different degrees of health. Sometimes they can never be made to grow at all, but periſh as ſoon as planted. Sometimes they

they advance a few feet high at firſt, in a languid ſickly condition, and preſerve, for a ſhort time, an appearance of life, without making almoſt any progreſs at all, and at length die away ſlowly, beginning at the top, and gradually deſcending to the root; and on ſome occaſions they grow to a tolerable ſize, but never have the appearance of ſound health and vigour, having their trunks always covered with moſs, the wood being ſoft and ſpungy, exceedingly brittle, and of little value, and the trees themſelves of no great duration, quickly falling to decay, unleſs the owner takes care to prevent it, by felling them very early.

As this never fails to be the caſe when the ſoil is of the nature that I have deſcribed, let every perſon of ſound judgment, who intends to make a plantation, careſully obſerve if his ſoil be of this kind, and be directed accordingly.

Whether

Whether any other of the coniferous trees would proſper in the ſoil in which this kind languiſhes, I cannot ſay, as I never have had ſufficient experience of theſe to enable me to draw any concluſions relating to this; but I think it highly probable, that ſome of them might anſwer in damp ground; eſpecially that kind ſent to us from North America, by the name of *ſwamp pine*, as it is probable that they have given it this name from its having been obſerved to grow in ſwampy ground.

It would be a ſubject well worthy the attention of men of fortune to try all the different kinds of trees in every different ſituation, and obſerve which kind proſpered beſt on every different ſoil, and publiſh their obſervations from time to time, either in a work on purpoſe, or in a miſcellany ſuch as your own, in which any ſingle obſervation might be inſerted without trouble, and preſerved without diſcover-

ing the author, if he ſo choſe: And I am diſpoſed to think, that if mankind had followed a plan of this kind, many eſſential improvements might have been made in many branches of knowledge; as it often happens that one man acquires a conſiderable knowledge in one particular ſubject, and another at a conſiderable diſtance may have made conſiderable diſcoveries in another, both of whom die, and the knowledge which they had acquired by experience dies with them; whereas, had each of theſe communicated their obſervations to the public, they would not only have improved each other, but alſo have tranſmitted their knowledge to many others, who might never have thought on the ſubject without being thus prompted to it.

It is but of late that the inhabitants of any part of Europe have beſtowed any attention to the cultivation of trees; for

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as all the northern parts of it were originally over-run with wood, it long required the induſtry of our forefathers, rather to free themſelves from being encumbered by it, than to be under any neceſſity of rearing it with care. But as mankind have encreaſed, and the number of domeſtic animals along with them, the old trees have been gradually cut down, and the young have been prevented from ſpringing up, which has made the woods gradually decreaſe, without being perceived by the inhabitants; ſo that in many places the want of wood has been felt before the inconveniencies that would ariſe from that want have been foreſeen; and it was not till mankind had felt theſe inconveniencies in a ſtrong degree, that they began to propagate trees by art.

Several nations, however, have been obliged, long before this time, to take this method of ſupplying themſelves with feuel,

and many other neceſſaries of life. But, as was moſt naturally to be expected, every country has cultivated only thoſe trees which were naturally produced in it, the ſeeds of which could be more eaſily procured than any others; and, whether theſe trees were more or leſs valuable than others, which might have been equally proper for the ſoil or ſituation, ſeems to have been but little attended to.

This ſeems to be the only reaſon why the *Scots fir* is ſo generally propagated in this part of the world, although it is a plant of a more unſightly appearance, yields a wood of leſs value, and is more difficult to rear than almoſt any other of the *coniferous* tribe. However, as the ſeeds of this tree can be met with every-where, and procured at a much ſmaller expence than any other kind, it ought not at preſent to be neglected, as it may anſwer the purpoſes before mentioned, till the other kinds can be

be alſo procured at a reaſonable price; but all the other kinds ought alſo to be attended to with care; and where-ever any of theſe trees are become ſo large as to carry ſeeds, theſe ſeeds ought to be gathered and ſowed, as the plants raiſed by this means would come almoſt as cheap as the others.

Which of all this claſs of trees is the moſt valuable, is perhaps at preſent difficult to ſay; as there are few people ſufficiently acquainted with all the different kinds; but it ſeems to me probable, that, of the tribe of *firs* properly ſo called, the one known by the name of *ſilver fir*, having ſhort thick leaves reſembling thoſe of the yew-tree, of a dark green on the upper ſurface, and white underneath, bids fair to be ranked among the moſt valuable of this claſs; and next to it, that kind commonly ſold by our nurſery-men under the name of the *ſpruce fir*, and known

known in ſome parts of the country by the contradictory name of *pine-fir*; as it is more than probable, that it is the one or the other of theſe trees which affords the fine deal brought to us from Riga, Dantzick, Norway, &c. and never that kind of tree that we commonly propagate here, which ſeems to afford a wood of a much inferior quality on all accounts.

My reaſons for believing that this is not the tree which affords the fine deal, are as follow.

The wood which is imported from abroad is on all occaſions ſo much ſuperior to our own, as could hardly be the caſe if it were entirely owing to the nature of the ſoil, as is generally imagined; for it is not to be ſuppoſed, that, in the vaſt tracts of country on which theſe trees grow from which we are ſupplied, there ſhould not be a great diverſity of ſoils, ſome of which could hardly

fail

fail to be of a nature ſimilar to our own, and produce wood of the ſame quality; neither is it to be ſuppoſed, that among the infinite variety of ſoils throughout this iſland, upon which theſe kind of trees have been reared, not one ſhould have been found of the ſame quality with any of thoſe in the countries where the wood we import is reared; and yet it is a fact well known to every one acquainted with theſe affairs, that the very beſt of the wood reared in this country, only approaches to the quality of the very worſt that is imported; the ſmall ſpars ſometimes brought from Norway being of a harder and tougher quality, and containing a larger proportion of red wood, and more diſtinct from the blue, than any of our own produce; which duly conſidered, gives at leaſt ſome room to believe that they are different.

I am ſtill the more confirmed in this opinion

opinion by the teſtimony of the biſhop of Bergen, who in his hiſtory of Norway takes notice, that there are two kinds of *coniferous* trees which ſpring up ſpontaneouſly in that country, the *fir* and *pine*; that the firſt is preſerved with great care, as it affords that valuable wood which they export in abundance; but they take every method they can think of to deſtroy the young pines, as the wood of theſe are of little or no value. Now, although he has not given us ſuch an accurate deſcription of either of theſe, as to enable us to know which ſpecies of either of the two genus's he has there mentioned; yet as it is well known that the tree which we falſely call *Scots fir*, is really a *pine* *, we are ſure that it cannot be *it*

* The botanical diſtinctions by which the fir, the pine, and larix are known, are theſe: The leaves of the fir come out from the branches ſingly; thoſe of the pine are united where they come from the branch, ſometimes two, three, four, or five leaves together; the leaves of the larix ſtand in great cluſters upon the branches.

that

that they cultivate; and as it is certain that the kind of *pine* which we call *Scots fir* is found in Norway, it affords a ſort of preſumption, that this may be the very kind which they ſo induſtriouſly deſtroy.

And I am ſtill more confirmed in this opinion, by having once ſeen a few ſmall ſpars which had been put into a ſhip from Riga, for the ſake of ſtowage, with the bark on them, which plainly diſcovered them to be of one of the two kinds of fir above mentioned, and not the *Scots fir;* the bark of which is very different from either of theſe two.

Such are the reaſons which induce me to believe that our common fir is different from the tree which produces the fine deal; which, although they do not amount to a full proof, might at leaſt be ſufficient to induce us to examine this ſubject with greater attention than has hitherto been done. And as it is an eaſy matter to get a

branch with the leaves and cones upon it from the countries where the fine wood grows, we might ſoon be ſatisfied as to the kind of tree which produces that wood by this means. This I have juſt now done, having written to ſeveral places for that purpoſe, and ſhall not fail to communicate to the public the reſult of my reſearches: but leſt I might be diſappointed or deceived by any accidental miſtake, I would be glad if any other gentleman of public ſpirit, who may read this, would do the ſame; that, by comparing our obſervations together, any miſtake which might proceed from the ignorance, inattention, or chicanery of thoſe who are employed to procure theſe ſpecimens, might have the better chance of being detected.

And as there are other uſes to which the *pine* and *fir* may be applied, ſuch as making tar, extracting roſin, turpentine, &c.

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ſome ſpecies of which afford more of theſe ſubſtances than others, it would be of much real benefit to the nation, if ſuch gentlemen as have an opportunity, either by means of correſpondents abroad, or in the courſe of their travels, would take the ſame method of aſcertaining the particular ſpecies of any of theſe trees which is moſt eſteemed at thoſe places where any of the manufactures above mentioned are carried on; that by this means any gentleman, whoſe ground was ſo ſituated as to be more properly adapted for one or other of theſe manufactures, by knowing the kind moſt proper to plant for that purpoſe, might prepare for it with the greateſt advantage. As there is no place where there are a greater variety of ſubſtances extracted from the *pine* than in the province of Guienne in France, in the neighbourhood of Bourdeaux, where they extract from it roſin, Burgundy

pitch, turnpentine and its oil, tar, pitch, lamp black, charcoal, &c. it would be of conſequence to diſcover which kind of this claſs of trees is there moſt eſteemed for each of theſe particular purpoſes. The ſame might be ſaid of Provence near Toulon, of Tortoſa in Spain, and throughout the greateſt part of the Swiſs Cantons; in all which places much uſe is made of the different kinds of *coniferous* trees. But there is one tree of this tribe, the *larix*, about which we can commit no miſtake, which, for its beauty and utility, deſerves to be much more cultivated than it is in this part of the world. But as I have already ſwelled this letter to too great a length for your Miſcellany, I ſhall defer my remarks upon this tree till another occaſion.

AGRICOLA.

[The

[The following anſwer to this letter appeared in the Weekly Magazine, June 6. 1771.]

SIR,

"YOUR correſpondent AGRICOLA appears ſo ſincerely deſirous to inſtruct and be inſtructed, that, finding myſelf qualified, by a long reſidence in the country from which our beſt wood is imported, to correct ſome of his miſtakes, and give him the information he deſires, and deſerves, concerning the Scots fir, at his invitation, I ſend you the following particulars, which you are at liberty to publiſh, if you think fit."

"The beſt red wood imported from the eaſtern countries is actually the produce of the tree known all over Scotland by the name of the *Scots fir*; and the white wood, which is more open in the grain, and of much inferior quality, is the produce of the

the ſpruce-fir. I ſhall give your correſpondent ſome reaſons for the prodigious difference which he obſerves betwixt the red wood, and the produce of the ſame tree in this country."

"AGRICOLA well obſerves, that ſand or gravel is the only ſoil for this tree. Gravel is by far the beſt: but he is miſtaken in ſuppoſing, that in theſe countries there muſt be a great variety of ſoils. The ſoil is all much the ſame, thin and gravelly; I mean the ſoil which ſpontaneouſly produces theſe trees; and they as naturally and invariably chuſe that kind of ſoil, as willows and allers chuſe the wet marſhy grounds. Beſides, theſe firs being the natural produce of the ſoils fitteſt for them, there is another reaſon for the ſuperior excellence of their wood, which is the ſlowneſs of its growth, and the great age the trees live to: inſtead of being upon the decline at about ſixty years old, as in our plantations,

plantations, in Sweden and Norway they are in full vigour at a hundred and twenty; the young wood is always full of knots, which wear out by length of years; and the ſlowneſs of the growth brings the wood to a firmneſs and conſiſtency very different from ours, which ſoon ruſhes up, and proportionably decays as faſt: this ſlowneſs of growth is to be attributed, not only to the poverty of the ſoil, but to the luxuriance of the branches, which are never lopped off, the pernicious practice of pruning fir-trees being altogether unknown in theſe countries."

"That the whole difference betwixt our own wood and the fine foreign wood, is occaſioned by the one being planted and pruned, the other ſpontaneous and untouched, is proved by ſome fir-wood, which I have ſeen brought from Braemar, at the head of the river Dee, equal, if not ſuperior, to any of the foreign red wood."

"But

"But as the natural wood is almoſt wore out of our country, let us, conformably to the views of AGRICOLA, do the beſt we can to ſupply its place, and chuſe the beſt ſoil we can get for planting; and even where the ſoil is not of the very beſt, give them as fair a chance for turning well out as it will admit of: In this we ſhould ſurely imitate the practice of the Swedes and Norwegians, in never pruning our Scots firs, but carefully weeding or thinning them at a proper age, which is a culture they beſtow on their firs, but think it not worth their while to take the ſame trouble about the pines. We muſt plant thick, that the young trees may ſhelter one another. As they advance, we find them crouded; and, to give them room, we prune them up, lopping off ſeveral tire of branches. This not only weakens the trees, by bleeding them, but makes them ruſh up very faſt; ſo that, as

Mr

Mr Rouſſeau obſerves of ſome plantations in France, they are not woods, but foreſts of maſts. Out of a miſtaken frugality, we do not chuſe to weed them, till they are of ſuch a ſize that they will ſell for ſpars, or ſome ſuch uſe; by which means they are almoſt wholly deſtroyed; for the roots having got no room to ſpread, when the wind gets in amongſt them after weeding, they are not able to bear it. This is a miſtake ſo generally given into, whether from ignorance, inadvertency, or a thirſt of too haſty gain, that I cannot take a ride any where, but my heart is ſorry to ſee numbers of (otherwiſe thriving) young plantations, all languiſhing and going to ruin, from this very error; and I am very happy to take an opportunity, through your means, Mr Printer, of warning my countrymen againſt it. I am, SIR,

Your humble ſervant,

Shire of Angus, May 25. 1771. SILVIUS."

[This produced the following anſwer, July 4. 1771.]

SIR,

I AM happy to think, that the obſervations I have ſent you on planting, may perhaps be the mean of inducing ſome more able pen to treat of that ſubject, and to furniſh the world new rules relating to it, founded on experience, the only ſure road to knowledge. Many men, as I already obſerved, do every day acquire a degree of ſkill, in ſome particular art or ſcience, far beyond that which falls to the ſhare of the ordinary part of mankind; and, as theſe are often too much engaged in buſineſs to think of writing, or have made too few original diſcoveries to furniſh matter for a new publication, the ſuperior degree of knowledge which they have acquired is never communicated to the world, but dies with the original poſ-

ſeſſor,

ſeſſor, and the public receives little benefit from their diſcoveries. There appears to me to be no method ſo well calculated to induce ſuch perſons to communicate their knowledge to the world, as for ſome perſon of ordinary parts to write a few familiar miſcellaneous eſſays on different ſubjects, and publiſh them in ſome amuſing periodical work, like your's. For as theſe eſſayiſts may frequently treat, in an imperfect manner, a ſubject which ſome other perſon who reads it may feel he underſtands more thoroughly, in ſeveral important reſpects; this will naturally make him deſirous of correcting the faults, or rectifying the miſtakes of the writer. And as he can do it with the utmoſt facility, without formally writing a book, or being invidiouſly criticiſed as an author, he will readily communicate to the public his own more valuable diſcoveries. It was in a great meaſure with this view

that I at firſt ſent you a few remarks on planting; and it will be with the ſame deſign that I ſhall continue to communicate ſome other obſervations on this ſubject, till I have brought under the view of your readers the principal circumſtances relating to it, which it is of importance for them to know; and the ſenſible obſervations of your correſpondent SILVIUS, give me room to hope that my views will not be entirely fruſtrated. One obſervation, founded upon actual experience, is undoubtedly worth five hundred plauſible theoretical conjectures, and will ever be ſo eſtimated by the ingenious inquirer after truth; ſo that I ſhall not deem the little pains which I have beſtowed upon this ſubject as thrown away, ſeeing it hath induced SILVIUS to write, and may perhaps be the means of bringing others to follow his example. Deſirous of acquiring knowledge on every uſeful ſubject, I receive it with

with pleaſure, from whatever hand it may proceed. Attached to no theory, and having no favourite ſyſtem to ſupport, I follow Truth where-ever I can perceive her, in whatever dreſs ſhe may appear, without regarding who it is that may preſent her, or in what manner ſhe may be introduced; and if at any time Error ſhould aſſume her amiable appearance, and be incautiouſly cheriſhed in her ſtead, I ſhall ever eſteem as my friend that man who ſhall diſcover the deceit, and puſh the ſecret enemy away. From this principle, I deſire that SILVIUS will accept my hearty thanks for the information that he hath given me concerning the Scots fir: but, as the mind cannot eaſily, and never ought to acquieſce in the belief of any thing as a truth, while any objections of ſeeming force remain againſt it, I could have wiſhed that he had been a little more explicit than he has been upon one point

that

that he treats of, as I apprehend that it might lead to errors in practice, unleſs it were more fully explained than he hath as yet done. And although I, who have beſtowed more attention on this ſubject than ſome others may have done, have little difficulty about the manner in which it ought to be underſtood; yet as the bulk of mankind are naturally indolent, and ſeem to avoid exerting the faculties of the mind, by not purſuing, with a due degree of attention, any ſerious diſquiſition, as naturally as they ſhun any ſevere bodily labour, ſeldom talking more of either than is barely ſufficient to amuſe, unleſs when compelled by neceſſity, they are too apt to take the words of a ſenſible writer in a more ſtrictly literal ſenſe than they ought, even in caſes where a ſmall degree of reflection might convince them of their error, and which the writer perhaps deemed ſo very obvious, as to think

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it unneceſſary to enter any caveat againſt; and much more ſo in caſes of a dubious nature. Poſſibly your ingenious correſpondent may not have ſufficiently attended to this circumſtance;—or I may be miſtaken. When he has read the following obſervations, he will be in a condition either to rectify my miſtake, or prevent the errors in practice that might have ariſen from his former obſervations.

SILVIUS rightly obſerves, that many of our plantations in this country are hurt by injudicious pruning; and ſtill more by a neglect of thinning at a proper age. Surely nothing tends more to promote the health of trees than a due proportion of freſh air, properly admitted to them; without which it is probable that no tree whatever can attain that degree of ſound vigour which is neceſſary for the formation of firm and laſting wood. A due proportion of branches is likewiſe neceſſary

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to pump up the juices from the roots,—to diſtribute the nouriſhment in right proportions to every part of the tree, and to allow the ſuperfluous moiſture to be freely perſpired by the leaves. But whether it is always hurtful in every ſituation to prune any kind of fir-tree, (as the expreſſions of SILVIUS would naturally lead us to ſuppoſe), ſeems to me extremely doubtful, for the following reaſons.

It is now clearly demonſtrated, from the experiments of Bonnet, Du Hamel *, and others, that trees encreaſe in bulk, not by a gradual extenſion of the parts, as is uſually the caſe with animals, but by an annual increment of new parts added to thoſe which have been already formed; ſo that, after a tree hath finiſhed its growth for a ſeaſon, the ſhoots, which had been produced at the top and at the extremities

* Particularly in his *Phyſique des Arbres*.

of

of the branches, never afterwards extend any farther in length, but for ever remain fixed as a baſis, from which new ſhoots may afterwards proceed. In the ſame manner the ring of young wood, that is formed upon the outer ſurface of the trunk and branches each year, which conſtitutes the annual increaſe in diameter, after the growth for that ſeaſon is over, never encreaſes in dimenſions, but ever remains of the ſame ſize, having a new ring of young wood applied above it next year, which alſo remains fixed as the former.

All theſe particulars are plainly perceived by the tranſverſe cut of any tree whatever; the age of which may be diſtinctly known by the number of fibrous rings of which it conſiſts. And if it be ſawed longitudinally, the fibres are as eaſily perceived in many trees, particularly the fir. It is a longitudinal ſection of theſe annual

rings which conſtitutes the threads ſo diſtinctly perceptible in every deal whatever.

The ſtructure of the branches is exactly ſimilar to that of the body of the tree. And as theſe, in every ſpecies of coniferous tree, muſt always take their riſe at the very heart, uſually branching out all round the ſtem nearly in a horizontal poſition, it neceſſarily follows, that wherever a branch ſprings out from the trunk, there the upright fibres of the body of the tree are obſtructed, and are bent outward nearly at right angles from the others; ſo that when the body of a tree is ſawed longitudinally into planks, at every place where a branch has ſprung from the tree, the fibres of the branch are cut tranſverſely, which has a very different appearance from the reſt of the wood, and forms the irregularity in deals that we call *knots*.

This being the caſe, it is obvious, that,

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at every place where a branch ſprings out from the trunk of a tree, there muſt be a knot in the wood; which will extend the whole way from the centre to the circumference, however great the diameter of the tree may be, if the branch was on it when the tree was felled. But if a branch be cut from the tree while it is growing, the ſtump from that time ceaſes to advance in ſize; and as the diameter of the tree continues to encreaſe, the cortical fibres gradually cover the wound;—it is ſoon healed up; the bark at that place becometh ſmooth, and the rings of wood are formed with as great regularity above the old ſtump as in any other part of the tree: So that when this is afterwards ſawed into planks, there will be found at every ſuch place a knot in the heart of the wood, which will extend to the ſame diſtance from the centre of the tree, as was its ſemi-diameter when the branch was cut;

but all beyond that to the circumference will be uniform, and free from knot or blemiſh of any kind whatever.

As all theſe are facts which cannot be conteſted, about the truth of which it is in the power of any one fully to ſatisfy himſelf whenever he pleaſes, by examining with attention any tree of this kind which may be in his way, it is evident, that if we could ſuppoſe it poſſible to find a *fir-tree*, which had retained all its branches from the firſt ſhoot that it had made to the laſt period of old age, the trunk of it could be nothing elſe but one great congeries of knots; ſo that the continuity of the fibres being broke off at the end of every year's growth, it would be unfit for any purpoſe where ſtrength was neceſſary, and in a great meaſure uſeleſs for every thing elſe. But if theſe branches had been taken away from the body of the tree when it was but of a ſmall diameter,

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the wood which had been formed by the encreaſe of the tree after that period, would be of an uniform texture, free from knots and flaws, and well fitted for carrying burdens, or for any other purpoſe.

From this view of the matter, it would ſeem, that if nature doth not ſpontaneouſly throw off the branches after a certain period, judicious pruning muſt be of the greateſt conſequence to aſſiſt in the formation of good and perfect wood of coniferous trees.

What may be the caſe in countries which are more favourable to the growth of this kind of trees, than our own is, I cannot ſay; but I am well ſatisfied that ſome aſſiſtance in this reſpect is of very great uſe on many occaſions in this country, as will, I believe, appear evident to any one who ſhall take the trouble to examine if the following obſervations relative to this ſubject are juſt or not.

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The fir-tree does not, like many other trees, ſend out branches irregularly, and of very different ſizes, ſome of which at leaſt equal, if not exceed the principal ſtem; but at the beginning of every year's growth a good many branches are ſent out all round the ſtem, many of which the firſt year are little ſmaller than the principal ſtem itſelf. Theſe continue to encreaſe in ſize each year for a conſiderable time. But as the ſap in all trees naturally aſcends with the greateſt vigour to the parts of it which are moſt upright; and as theſe branches are nearly horizontal, a greater proportion goes to the uppermoſt ſtem than to any other part: So that this, and the parts of the tree which are neareſt to it, grow with a greater degree of vigour than thoſe which are farther removed from the top. And as the top of the ſtem advances upwards, and recedes farther from the firſt formed branches, theſe gradually

gradually receive a ſmaller ſhare of nouriſhment, and each year make ſmaller progreſs in their growth, till at laſt they ſtop entirely,—continue a few years upon the decline, and gradually die away.

This is the natural progreſs of the fir-tree, which I apprehend muſt take place more or leſs in every ſituation; although the number of growing branches will always be greater where they have room to ſpread freely on every ſide, than where they are more confined; and the wood, for the reaſons above enumerated, never can be good but where the trunk of the tree has been free of branches for a great number of years.

How long time it would take for a tree ſpontaneouſly to free itſelf of its dead branches, I cannot pretend to ſay; but it could not be effected in a ſhort period, ſeeing it can only be produced by the gradual decaying of the branches, which would

would fall away in proportion as they rotted; to effect which entirely muſt require a great many years, as ſome of the branches are of a conſiderable ſize, and conſume but very ſlowly. Now, as theſe branches continue to form knots in the wood during the whole time that they adhere to the tree; and as they *cannot* be of the ſmalleſt ſervice to it in any way after they are dead, but, on the contrary, *muſt* be of conſiderable detriment to the wood; it would ſeem to be a branch of culture extremely neceſſary, to lop off all theſe cloſe by the ſtem, as ſoon as they were dead at leaſt; and it does not appear quite clear, but that, in many caſes, it might be an advantage to the wood even to prune off ſome of the living branches, or thoſe which ſhewed evident marks of decay.

Although I agree entirely with your correſpondent about the great utility of early

early thinning, and am by no means an advocate for that *exceſſive* pruning which he ſeems to reprehend; yet as I have at preſent before my eyes a moſt convincing proof of the great loſs ariſing from the total neglect of this neceſſary branch of culture in a wood, the trees of which are, indeed, of almoſt no value at all from this cauſe, I thought the above caveat was neceſſary: I muſt likewiſe add, that the fineſt young fir-wood that I ever ſaw in Scotland, was reared by a gentleman, who was exceedingly careful to prune his trees every year; but he was a judicious man, and took care not to over-do. The nature of the tree, and the uſes to be made of the wood, abſolutely require that it ſhould have the diſagreeable appearance, when growing, that Mr *Rouſſeau* complains of; and it would be but a very indifferent maſt indeed, which had not had

a naked ſtem for many years before it had been felled.

Let the reader carefully remark, that I here ſpeak only of the *fir-tree*. The manner in which branches come out from the ſtems of other trees; their way of growing, as well as the effects they have upon the wood being very different from theſe, they require a very different treatment from the above. And although I am not fully ſatisfied that the great number of branches will tend to make the trunk encreaſe more ſlowly; yet as this is but a matter of mere ſpeculation, and this letter is already too long for your Miſcellany, I ſhall not at preſent take up your time by inſiſting any longer upon that head: But if none of your correſpondents chuſe to favour us with any remarks upon the effects of branches on the growth of *deciduous* trees, and the proper method of pruning theſe, I may perhaps, on ſome future

future occaſion, be tempted to throw out ſome hints relating to that ſubject, to ſee if I can induce them to communicate to the world any diſcoveries they may have made relative thereto.

AGRICOLA.

[This produced the following anſwer.]

SIR,

"I Should long before now have replied to the queries and doubts of AGRICOLA, concerning pruning of fir-trees, ſuggeſted by him in conſequence of my indiſcriminate condemnation of that practice. This gentleman's accuracy, zeal, and attention to inſtruct the public in ſeveral branches of real uſe and importance, deſerves all poſſible regard to be ſhown to whatever he throws out; it was only a ſenſe of how little I had to advance

concluſive upon the ſubject, that has rendered me backward in offering it; and I ſtill ſubmit it to you, Mr Printer, whether what follows is of conſequence enough to take up a place in your paper.

" As what AGRICOLA advanced in favour of pruning fir-trees, appeared to me to carry a great deal of weight and reaſon along with it, I would not depend on my own memory or opinion for ſettling the point; but having an opportunity at hand, I applied to a native of Wermerland, which produces the beſt fir-wood in Sweden, above two hundred miles from the coaſt; he is a ſenſible fellow, and very capable of giving information about a place which ſtrangers can know little of.

" Upon aſking him if they ever pruned their beſt fir-wood, he told me with a ſmile, it was abſolutely impoſſible, on account of their extent, and, as he thought,

quite

quite unneceſſary, as they always pruned themſelves; that all they could do where they expected the beſt wood, was to hew down the weakly and over-topped, to make room for the reſt, and that even this thinning was but very ſuperficially performed; he allowed it would be much for the advantage of the remaining trees, if this were done to better purpoſe; but the low price, and immenſe extent of the woods, forbid it. Whether they would be the better for pruning, my Swede could not ſay, as it is a thing he had no experience of; but it was his opinion, that the great difference in quality betwixt our wood and theirs, was chiefly owing to the great age of the trees in Sweden, as he had obſerved, that if they were cut too early, the deal was always knotty, and very open in the grain.

"Upon inquiry, I alſo find, that the beſt fir-wood in Scotland, produced by nature

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in the Highlands, is never pruned; ſo that in theſe points experience contradicts the theory of AGRICOLA; though I muſt own, to me it appears as reaſonable as it is ingenious and accurate: here we find, that in ſpite of the annual production of a whole row of horizontal branches, each of which forms a knot in the parent tree; in ſpite of the length of time that theſe branches remain before they fall off, and the rough ragged ſtumps they often leave behind, the tree is actually filled up, and covered by new coats of wood, and the deal is found to be as free of knots as can be wiſhed.

" Still it muſt be conſidered, that the trees we ſpeak of in Wermerland and Braemar, are Nature's favourites, children of her own, to whom ſhe ſhows that kindneſs which we cannot expect her to extend to thoſe whom we force her to adopt: therefore it remains with me doubtful, whether

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in our more weakly plantations pruning as well as thinning may not, if judiciouſly performed, be a proper help and culture for them; but under this limitation, which, in my opinion, it is abſolutely neceſſary to obſerve, of never touching a branch till it ſhows evident ſymptoms of decay; for the miſchievous conſequences of making them ruſh up too tall, and of bleeding them, by wounding the green reſinous wood, is very apparent. Your's, &c.

Auguſt 3. 1771. SILVIUS."

As the matter in agitation is ſtill left a little doubtful, I ſhall uſe the freedom to tranſcribe a very ſenſible account of the Scots pine by James Farquharſon of Invercauld, Eſq; publiſhed in the Philoſophical Tranſactions, which will remove every difficulty that remains on this head.

"It

"IT is generally believed that there are two kinds of fir-trees, the produce of Scotland, viz. the red or reſinous large trees, of a fine grain, and hard ſolid wood. The other, a white-wooded fir, with a much ſmaller proportion of reſin in it, of a coarſer grain, and a ſoft ſpungy nature, never comes to ſuch a ſize, and much more liable to decay: At firſt appearance, this would readily denote two diſtinct ſpecies; but I am convinced that all the trees in Scotland, under the denomination of Scots fir, are the ſame; and that the difference of the quality of the wood, and the ſize of the trees, is entirely owing to circumſtances; ſuch as the climate, ſituation, and ſoil they grow in. The fineſt fir-trees appear in the moſt mountainous parts of the Highlands of Scotland, in glens or on ſides of hills, generally lying to a northerly aſpect, and the ſoil of a hard gravelly conſiſtence, being the

the natural produce of theſe places; the winged ſeeds are ſcattered in quantities by the winds, from the cones of the adjacent trees, which expand in April and May with the heat of the ſun; theſe ſeedings, when young, riſe extremely cloſe together; this makes them grow ſtraight, and free from ſide-branches of any ſize, to the height of 50 or 60 feet, before they acquire the diameter of a foot: Even in this progreſs to height, they are very ſlow, occaſioned by the poorneſs of the ſoil, and the numbers on a ſmall ſurface, which I may ſay makes them in a conſtant ſtate of war for their ſcanty nouriſhment, the ſtronger and talleſt by degrees overtopping the weaker, and when the winds blow, they laſh againſt one another; this aſſiſts in beating off any horizontal branches that might damage the timber with knots, as well as by degrees cruſhes the over-topped trees. In ſuch a ſtate of

hoſtility they continue ſtruggling, until the maſter-trees acquire ſome ſpace around them; then they begin to ſhoot out in a more buſhy manner at the top, gradually loſing their ſpiral form, encreaſing afterwards more in ſize of body than height, ſome acquiring four feet diameter, and above ſixty feet of height to the branches, fit for the fineſt deal-boards. The growth is extremely ſlow, as is plainly proved by the ſmallneſs of the grain of the wood, which appears diſtinctly in circles, from the centre to the bark. Upon cutting a tree over cloſe at the root, I can venture to point out the exact age, which in theſe old firs comes to an amazing number of years. I lately pitched upon a tree of two feet and a half diameter, as this is near the ſize of a planted fir of fifty years of age mentioned, and I counted exactly two hundred and fourteen circles or coats, which makes this natural fir above four

times

times the age of the planted one. Now, as to planted firs, theſe are raiſed firſt in dreſſed ground from the ſeed, where they ſtand two ſeaſons, or more, then are planted out in the ground they are to continue in at regular diſtances, have a clear circumference round them for extending both roots and branches; the one gives too quick nouriſhment to the tree, which ſhoots out in luxuriant growths, and the other allows many of the branches to ſpread horizontally, ſpoiling the timber with knots; beſides, this quick growth occaſions theſe thick yearly circular coats of wood, which form a coarſe grain, of a ſpungy ſoft nature. The juices never after ripen into a proportional quantity their reſinous preſervative balm: So that the plantations decay before the wood acquires age, or a valuable ſize, and the timber, when uſed in work, has neither ſtrength, beauty, nor duration. I believe

the climate has likewiſe a great ſhare in forming the nature of the beſt wood; which I account for in the following manner: The moſt mountainous parts of the Highlands, particularly the northerly hanging ſituations, where theſe fine fir-trees are, have a much ſhorter time of vegetation than a more ſoutherly expoſure, or the lower open countries, being ſhaded by high hills from the rays of the ſun, even at mid-day, for months together; ſo that, with regard to other vegetables, nature viſibly continues longer in a torpid ſtate there than in other places of the ſame latitude. This dead ſtate of nature for ſo long a time yearly appears to me neceſſary to form the ſtrength and health of this particular ſpecies of timber. No doubt they may at firſt ſhow a gratefulneſs for a better ſoil and more ſun, by ſhooting out ſpontaneouſly; but if the plant or tree is ſo altered by this luxury that it

cannot

cannot attain any degree of perfection fit for the purpoſes intended, the attempt certainly proves in vain.

" From what is ſaid above, it is not at all my intention to diſſuade from planting Scots fir, but to encourage thoſe that have the proper ſoil and ſituation to do ſo, being of opinion, that where theſe circumſtances agree, and there planting, not in lines, but irregularly, and thicker than common, the trees will come to be of equal ſize and value with the natural ones. In confidence of this, I have planted ſeveral millions on the ſides of hills, out of reach of ſeed from the natural firs."

There was never perhaps penned a plainer, more conciſe, and ſatisfactory account of the nature and growth of any tree, than is contained in this very ſhort extract: at leaſt ſo it appears to me.

By attending to it, we ſee the reaſon why

why natural fir-woods, although not pruned, are quite free of knots, as they neceſſarily prune one another before the ſide-branches attain any conſiderable thickneſs.

But if fir-trees are planted at ſuch a diſtance from one another as to allow the ſide-branches to grow till they attain a conſiderable degree of thickneſs, there can be no doubt that the wood muſt be knotty throughout its whole length; ſo that, in theſe caſes, clean wood cannot be expected but where the trees are regularly pruned every year, ſo as to leave only a ſmall top with branches on it.

If this account be juſt, we ought alſo to doubt if the thinning recommended by SILVIUS would be attended with the benefits he ſeems to expect from it: for although it might probably make the trees advance more quickly, it would alſo make the wood be of an inferior quality.

There

There would likewiſe be danger that if this was done at an early period, while the trees continued to advance in height, there would be a neceſſity of pruning them after they were thinned, to prevent the wood from becoming knotty and foul. On theſe accounts, where fine wood is required, it is perhaps beſt to leave the wood entirely to itſelf.

But where the view of the proprietor is to obtain large trees in a ſhort time, without regard to the fineneſs of the quality of the wood, he will beſt ſucceed by planting the trees at ſuch a diſtance from one another as to allow them abundant nouriſhment, if the ſituation is ſo well ſheltered as to admit of this. But in theſe caſes there will be a neceſſity of pruning the trees regularly, otherwiſe the wood would not only be full of knots in every part, but the trees would taper ſo much towards the top as to render it of little va-

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lue for thoſe uſes to which this timber can be properly applied.

It is found by experience, that thinning a plantation of pine or fir trees, unleſs when they are very young, and covered with branches almoſt cloſe to the ground, is always attended with very great danger. So long as they continue to grow cloſe by one another, with the branches of their tops intermingled with each other, every tree gives and receives ſupport from thoſe around it: but when this ſupport is taken away, by felling out any of the trees, the wind acts with ſuch force upon the top, which is at ſuch a diſtance from the root, and is ſupported by a tall and feeble ſtem, as neceſſarily either breaks it over,—tears it out by the roots, or warps it ſo much as to cauſe it languiſh ever afterwards, and die altogether in a few years. To avoid this inconvenience, it is perhaps always adviſeable to leave a plantation of conife-

rous

rous trees untouched, till the time it is intended to be felled altogether,—and then to cut clean out at once as far as you intend to go. It is even doubtful if it is proper to cut down thoſe trees that die by the overſhadowing of the others, unleſs where they are entirely overtopped.

We ſee many plantations of pine-trees in Scotland, where the whole bark of the trees are encruſted with fog,—and the trees in a languiſhing condition. This is often aſcribed to the thickneſs of theſe plantations, which excludes the air from them: but it is always owing to the nature of the ſoil. A thouſand plantations of pines are made in Scotland on ſoils upon which this kind of tree will not thrive, for one that is made on a proper ſoil:—So it is not ſurpriſing, that, in theſe circumſtances, we ſhould frequently meet with plantations of ſickly trees of this ſort.

If ever we hope to have ſucceſs in planting

timber, let us not be ſo unreaſonably attached to the culture of one tree, as to exclude all others;—and let us never forget, that the common pine-tree, called *Scots fir*, will not live almoſt at all on a clayey ſoil,—does not proſper on a loam,—and is only ſeen to thrive upon ſand or firm gravel, which is allowed to be the ſoil it moſt affects.

I now proceed to take notice of ſome other kinds of trees.

LETTER

LETTER FOURTH.

Of the Larch-tree;—*The valuable Uſes to which it may be applied;*—*Manner of obtaining its* Roſin.

SIR, *May* 30. 1771.

ALTHOUGH the *larix* is not a native of Britain, yet the lively verdure of its foliage, and the elegant figure of the whole plant, has recommended it to the attention of our countrymen as an ornamental tree, although it is not as yet become ſo common as to have its value, as an uſeful tree, ſufficiently known. But in *Italy*, in *Carinthia*, and the country of the *Griſons*, and throughout the whole extent of the *Alps*, where it grows in great

abundance, it is eſteemed the moſt valuable tree that they have: and it is there valued for ſo many excellent qualities, that I cannot help recommending it, in the warmeſt manner, to the attention of my countrymen.

We ourſelves have daily proofs before our eyes, that few trees advance ſo quickly as this does: and the teſtimony of all travellers invariably agrees in aſſerting, that it thrives in the pooreſt ſoil, and moſt expoſed ſituation, there growing to a prodigious height and magnitude, being often found eighty feet high or upwards, with a trunk perfectly ſtraight throughout its whole length. The wood of this tree is likewiſe much eſteemed for its exceeding great durability, it being almoſt incorruptible either in the open air or under water; as is clearly demonſtrated at *Venice*, the greateſt part of which city is built upon *piles* of wood; which are not only

only ſtill freſh, although they have remained there for many hundred years, but they have at length acquired ſuch a degree of hardneſs, and in ſome meaſure to reſemble iron, ſo as to reſiſt the edge of the beſt tempered tool.

I need not point out the utility that a wood poſſeſſed of this valuable property might be of to a country like this, which depends ſo much upon its navy for its preſervation and well-being, as it promiſes to be a ready ſuccedaneum for the *oak*, and, for ſome particular purpoſes, would ſeem to be even more valuable than it; for although the ſtraightneſs of the tree would never allow it to be proper for ribs or knees, yet, for outward cleathing, it might perhaps be more valuable than the *oak*, as it would be lighter and more buoyant, and poſſibly might reſiſt the worms in warm climates; at any rate, it would not be ſo apt to ſplinter during the time

time of an engagement, which would ſave many uſeful lives, that are always loſt on theſe occaſions by the ſplinters of the *oak*. Along with theſe properties, we ought always to remember, that as it is of much quicker growth, we could much more eaſily ſupply ourſelves with this kind of timber than with *oak*. All which conſiderations makes it merit the attention of every ſincere friend to his country, at leaſt ſo far as to get a fair trial made, to ſee whether it would anſwer all theſe valuable purpoſes or not.

But whether it may anſwer all theſe purpoſes or not, it is undoubtedly poſſeſſed of other properties which render it well worthy our peculiar care. In the countries where this tree grows in abundance, the common people, on many occaſions, make their houſes entirely of it, as they are, at the ſame time, the cheapeſt and moſt comfortable habitations that they could

could poſſibly rear. The walls are formed of ſquare logs placed by one another's ſides, kept cloſe to one another by a ſtrong beam going acroſs the top of the whole, the other parts being kept firm by ſtrong pins.

When it is firſt put up, it appears quite white, but in a ſhort time there oozes forth from the pores of the wood a great quantity of a reſinous juice, which hardens by the air, and becomes of a black colour, forming a thick coat of varniſh over the whole ſurface of the wood, which preſerves it from the corroſive effects of the air; and as the interſtices between the logs are filled with the ſame varniſh, when it dries it cements the whole together, forming one ſolid body, totally impervious to every blaſt.

The roof is covered with thin boards of the ſame wood, cut into the form, and put on nearly in the ſame manner as ſlates,

and

and by them called *cingles*, which are ſoon covered with a varniſh, and cemented together in the ſame manner as the walls. This forms the lighteſt, cloſeſt, moſt durable, and cheapeſt covering that could poſſibly be got; and the whole habitation is ſo neat, ſo warm, and ſo ſecure, as muſt be extremely comfortable to the inhabitants, very different from what is experienced by the poor poſſeſſors of the wretched hovels to be met with in every country of Europe, where they have not the convenience of theſe materials.

And as it muſt be acknowledged, that Britain feels no ſuch capital defect in any of the eſſential neceſſaries of life, as in wanting proper materials for roofs to the houſes of the lower claſs of people; therefore we ought very much to prize any thing which promiſes to remove this defect. *Slates* are indeed a good covering, but are not only weighty, but come ſo high

high as not to be within the power of any but the great and opulent to purchaſe: *Tiles*, although light and tolerably cheap, are ſo ſoon wore out, and ſo liable to accidents from winds, as render them a troubleſome and uncomfortable roof.

The only alternative which remains for the poor people beſides theſe, is either *thatch* or *turf*, both of which require ſuch continual repairs, on account of the periſhable nature of the materials,—ſuch conſtant attendance to guard againſt accidents from wind, and are at beſt ſuch a poor defence againſt the inclemencies of the weather, as but ill repays the poor inhabitants for the perpetual expence, and labour, and care, and watching, to which they are continually ſubjected on this account; not to mention the damage they ſuſtain by the crouds of vermine, to which theſe at all times afford a ready ſhelter, or the danger they run of being ſet on fire

from every caſual accident; all which united, form ſuch a complication of diſtreſſes, continually hovering over the head of this claſs of people, as muſt have a tendency to damp that lively vivacity of ſpirit, the exertion of which conſtitutes the principal happineſs of man, and tends to inſpire a deſponding indifference, which ends in languor, inactivity, and miſery. Every humane mind, therefore, muſt ſurely feel a ſenſible pleaſure in the proſpect of being able to remove theſe diſtreſſes from ſo many of his fellow-creatures, and beſtow a particular attention to the rearing of this tree, which promiſes to ſupply theſe defects.

I had almoſt forgot to mention, that this wood is reckoned of ſuch a quality as to be almoſt incombuſtible, reſiſting the fire in ſuch a degree, as only to conſume in a very great heat extremely ſlowly.

What credit is to be given to this opinion,

nion, I cannot ſay; but as it is as old as *Pliny*, and is ſtill believed in the countries where this wood is common, it is probable that there muſt be ſome foundation for it; and I am the more inclined to believe that this is the caſe, from having heard that an *Italian* of ſome note wrote a book on this ſubject; the deſign of which was to perſuade his countrymen to uſe this in ſome caſes as fire-wood; but the only caſes in which he recommends it, is for heating furnaces, and other large works; becauſe, ſays he, when a great quantity of it is put into a well-draughted furnace, it may be made to burn very well: But as he does not ſay that it could be made to anſwer the ordinary uſes of life in a common grate, I think we may conclude, that from experience he had found it would not burn well in any other circumſtances than theſe he deſcribes.

But, valuable as the wood may be, it is

not on this account alone that the inhabitants of *Italy* prize it ſo much; they likewiſe make uſe of its bark for tanning leather, and from the body of the tree, while growing, they extract that reſinous balſam, commonly known by the name of *Venice turpentine*, which yields them a very conſiderable revenue. The manner of extracting the turpentine is as follows.

The whole of the wood of the *larch*-tree is richly impregnated with this reſinous juice, and, when young, it is almoſt equally diffuſed through all the parts of it; but as the tree advances in ſize, there is gradually formed in the body of the wood, eſpecially near the root of the tree, ſmall cavities, which are filled with this liquid roſin, quite pure, and ſeparate from the wood. As the tree grows bigger, theſe cavities likewiſe encreaſe, inſomuch, that, when a tree is in full vigour, and of a conſiderable magnitude, theſe will

ſometimes

ſometimes be found about an inch in thickneſs, three or four in breadth, and as much in height.

Theſe cavities are chiefly met with about five or ſix inches from the heart of the tree; and it is generally obſerved, that, in the trunk of a tree about forty feet in length, there will be found about ſix or ſeven of theſe principal reſervoirs, and a great number of ſmaller.

When the trees begin to decline, the cavities contract, and afford but little turpentine; for which reaſon, the workmen ſeldom chuſe a tree that is very young or very old, as neither of theſe would yield much of this balſam, but prefer ſuch trees as are of a conſiderable magnitude, and ſtill in high vigour, before all others.

To extract this reſinous juice, (if I may ſo term it), they bore a hole into each tree in the month of March, piercing very near to the heart of the tree, and making the

the hole ſlant a little upwards, to allow the balſam which may be collected in it to flow out more eaſily. To each of theſe they fix a ſmall tube of wood, at the end of which they hang a veſſel for receiving the roſin as it flows from the tree. They come to the wood every morning, from the end of May till the end of September, to empty the veſſels which are hanging at the tree, the balſam taken from which they carry home, and keep in proper veſſels till the end of the ſeaſon; and when they can obtain no more, they ſtrain the whole through a cloth, and put it in proper veſſels for ſale.

This is a ſemifluid balſam, which never hardens in the air, and is commonly ſold by the name of Venice turpentine, although it is of an inferior quality to that obtained from the *fir-tree*, which is the only genuine kind. If it is diſtilled with water, it yields an eſſential oil, which is likewiſe

likewiſe called *oil of turpentine*, although it is alſo of an inferior quality to that obtained from the fir-tree.

Such is the proceſs for obtaining the turpentine from the *larix*, the profits ariſing from which muſt be very conſiderable, ſeeing it is generally computed, that a vigorous larch-tree will yield ſeven or eight pounds of turpentine every year, for forty or fifty years *.

Beſides all theſe different ſubſtances, the *larix* likewiſe yields a ſpecies of *manna*, known by the name of *manna laricea*, or *manne de Briancon*, much praiſed by the antient hiſtorians of Dauphinè. This ſubſtance is found chiefly among the Alps, and appears in the months of May and

* The uſual ſelling price of this roſin, I am told, is about 6 d. per pound. But ſuppoſing it were only 2 d. the annual produce at the above rate would amount to 1 s. 4 d. or 1 s. 6 d. per tree.—A Scots acre contains 450 trees at ten feet from one another; at which rate, the annual produce would be L. 28 : 2 : 6.

June, in the form of ſmall whitiſh grains, the young trees being entirely covered by them, ſo as to be all over white, as if covered with hoar-froſt. It muſt be gathered early in the morning, as the ſun diſſipates it at his firſt appearance, as readily as the dew. But as I apprehend that this ſubſtance is but of little value, it is hardly worth attending to.

Upon the whole, I flatter myſelf that the reader will agree with me, in being ſatisfied that this tree ſeems to be poſſeſſed of ſo many valuable properties, as to demand, in a particular degree, the attention of our countrymen. That they may be induced to propagate it in greater abundance, and ſoon feel the good effects ariſing from that, is the ſincere deſire of

AGRICOLA.

LETTER

LETTER FIFTH.

General Observations on the different Circumstances that ought to be attended to in making a Plantation of Trees in different Situations.

SIR, *June* 13. 1771.

I AM so much persuaded of the benefit which might accrue to the nation in general, as well as the advantage which individuals might reap from planting trees, if it were duly attended to, that I would willingly remove every objection to this valuable improvement that occurs to me. What I have already said may probably obviate some of these; but I am sensible

that there are many others which ſtill remain to be conſidered; and as ſome of theſe at preſent occur to me, I ſhall briefly mention them, in order to prevent any young or inconſiderate perſon from engaging too raſhly in an undertaking of this kind, and point out many circumſtances relating to this ſubject, which are of very great conſequence, although they are at preſent never in the leaſt attended to.

It is not on all occaſions enough that wood can be made to grow; for if we have not a market for that wood, or ſome method of diſpoſing of it to advantage, it can be but of very little advantage to the proprietor. As this is a conſideration of the utmoſt conſequence, it ought to be attended to with the utmoſt care, and every circumſtance ought to be duly weighed before any conſiderable plantation is made.

For this purpoſe, it will not only be neceſſary

ceſſary for every one who intends to raiſe a plantation, to conſider what kind of trees are moſt likely to thrive beſt upon his particular ſoil or ſituation, but alſo to endeavour to diſcover which kind will be moſt properly adapted to the market to which he can bring it. With this view, he ought to attend to the ſituation of all the objects around, and ſee what influence they may probably have upon his project: He ought even to pay attention to the *prejudices* of the people among whom he is placed, as theſe often have a much more powerful effect upon the mind of man than a ſpeculative recluſe would be apt to imagine; and, however chimerical theſe may ſometimes be, yet as they often produce very ſerious conſequences in life, they ought by no means to be deſpiſed.

The moſt ſuperficial obſerver muſt here remark, that the value of wood of the

ſame quality muſt vary prodigiouſly in different places; but, in general, we muſt deem thoſe ſituations particularly favourable which are near any large and populous place; and the man may be eſteemed happy in this reſpect who is ſituated near a ſea-port, or upon a navigable river; or who inhabits a populous country where wood is ſcarce, and every branch of value: Such a one ſets out with great advantages, and can reap profit from every article; but in an inland or mountainous country, at a diſtance from markets, far from every navigable river, and deſtitute of roads upon which weighty carriages could paſs, of what value would be the *wood* of the fineſt trees that could be reared? They might ſtand till they were overturned by the tempeſt, before any one could offer to purchaſe them; and their ſtately trunks, afterwards mouldering in the duſt, could only excite a melancholy

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ſigh from the paſſing traveller, without a poſſibility of making it turn out to any account.

What ſhall be done in ſuch a ſituation? Is the proprietor of theſe places, who, by his ſituation, muſt ever be deprived of the power of carrying on any othe valuable improvement, likewiſe to be deprived of every advantage that he might reap from this one, which is ſo eaſily within his reach? Muſt he, by being obliged to give up all hope of reaping any advantage from this, ſit down in deſpair, and draul out a life of liſtleſs inactivity, without being able to exert the animating ſpirit of induſtry, of rouſing into life the half-extinguiſhed powers of thoſe around him, and of pouring the bleſſings of vivacity and plenty upon the miſerable wretches who are now depreſſed with poverty, and debilitated with indolence? Hard, indeed, would be the ſituation of ſuch a one were

this

this the caſe; but ſo careful has the beneficent Creator been for the happineſs of man, that he has left no climate upon our globe, which does not yield ſome uſeful product, nor any ſoil deſtitute of vegetables for the comfort of the human race; nor any ſituation in which the induſtry of man may not convert the produce of the ſoil to ſome valuable purpoſe for himſelf and his fellow-creatures.

Although there are many ſituations in which it is impoſſible to make any profit of the *wood* of trees in ſubſtance, yet as many of theſe yield ſome other produce of great value, independent of that, it is impoſſible to conceive a ſituation in which profit may not be made of a plantation of trees, as I hope to be able to demonſtrate in the moſt ſatisfactory manner. If the wood is of no value, it is ſtill in his power to extract from it *turpentine* and its oil, *roſin*, *tar*, *pitch*, and *lamp-black*, which can eaſily

eaſily bear the expence of tranſporting. If it is not proper for theſe, it may be reduced to aſhes, and afford the valuable ſubſtance called *pot-aſh*. In ſome ſituations charcoal may be of uſe, and in others the bark becomes of great value; and ſugar may be extracted in abundance from trees which may yet grow in our moſt barren mountains; nor is it impoſſible but the Caledonian hills may yield from their trees a wine not inferior to thoſe which the grape affords in warmer climates.

Some will think that I am now advancing into the regions of romance; but let not any one condemn me, until he has heard the method in which all theſe and other products may be obtained; and if he then thinks ſo, I give him full liberty to condemn me.—In the mean time, I have not the ſmalleſt ſcruple to declare, that, by attending to theſe circumſtances I have mentioned, and making a plantation, with a

view

view to extract that particular ſubſtance from the trees which will be beſt adapted to the ſoil and ſituation of the place, very great profits may be made from ſuch plantations in every part of the iſland: and, to convince my countrymen of this, I ſhall perhaps, upon ſome future occaſion, deſcribe the manner in which the moſt valuable of theſe ſubſtances above mentioned are obtained.

AGRICOLA.

LETTER

LETTER SIXTH.

On the Fir-tree, *and Method of extracting its* Turpentine.

SIR, *June* 20. 1771.

I ALREADY remarked, that it is probable that the *ſilver-fir* is the tree which affords the fineſt deal. Whether this is really the caſe, I cannot poſitively aſſert; but certain it is, that this tree alone produces the genuine balſam known by the name of *Venice turpentine;* for although the *larix* affords a reſinous juice, ſomewhat of the ſame nature which is uſually ſold under the ſame name, yet it is of a quality much inferior to that which is extracted from the *fir-tree*, and ſells at a

much lower price. As this ſubſtance is of conſiderable value, and may in many ſituations afford the principal revenue which can be drawn from a plantation of this kind of trees, I ſhall briefly deſcribe the method of collecting it.

The liquid roſin which exudes from this ſpecies of *fir-tree*, inſtead of being lodged in the wood as in the *larix*, is collected in ſmall cavities formed in the bark of the tree, incloſed in a thin film or bag, which, when full, forms ſoftiſh excreſcences upon the ſurface, eaſily diſtinguiſhable by the eye. Theſe little bags, filled with roſin, begin to appear when the tree is about three inches in diameter; from which time they continue to encreaſe, and yield every year a greater quantity of roſin, till the tree becomes about a foot in diameter; about which time the bark begins to grow hard and woody, and the cavities become ſmaller, ſo as gradually

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to yield leſs and leſs after that period.

From this peculiarity in the manner of yielding its juice, we may obſerve, that it would be extremely proper to plant this ſpecies of *fir-tree* along with the *larix*, in thoſe ſituations where the roſin is a principal object of conſideration; becauſe as theſe trees yield their roſin when very young, while the *larix* only affords its balſam at a more advanced age, a conſiderable profit might be drawn from them before the *larix* was of ſuch a ſize as to yield any turpentine; and when the *larix* ſhould advance in ſize, and require more room, theſe might be cut out, after they had furniſhed all the turpentine they could yield.

In order to collect this roſin, the peaſants in the north of Italy, where this roſin is chiefly gathered, provide themſelves with a ſmall white-iron veſſel, wide at one end and ſharp at the other, ſomewhat reſembling a horn, with an open kind of

flaſk hung by their ſide, and a pair of iron crampets fixed to the inſide of their feet, to ſtrike into the tree to aſſiſt them in climbing it. Being thus equipped, they go out every year in the month of Auguſt to the woods; and examining every tree with care, where-ever they diſcover one of theſe bladders of roſin, they thruſt the ſharp point of their white-iron inſtrument into the under part of it, and thus make an opening, through which the roſin flows into the wider part of the veſſel. They then mount upwards; opening every bag of roſin as they aſcend, emptying the ſmall veſſel from time to time, as occaſion may require, into the flaſk at their ſide.

In this manner they proceed from day to day, emptying their flaſk every night into a larger veſſel, which they take care to provide for that purpoſe; and when they have collected the whole that they intend to gather that ſeaſon, they

filtre

filtre it through a ſtrong cloth, to free it from leaves and other impurities, and then put it into proper veſſels for the market. If this is put into a cucurbit with a little water, and diſtilled, the eſſential oil riſes free from the groſſer ſubſtances with which it was united, and forms the genuine oil of turpentine. What remains in the cucurbit is a dryiſh roſin, ſomething like *colophony*.

The *ſpruce-fir* likewiſe affords a roſin in conſiderable quantities, although differing greatly in quality from that obtained from the *ſilver-fir*, and is procured by a very different operation; for whereas the true turpentine from the fir is always in a ſort of ſemi-fluid ſtate, that obtained from the *ſpruce* * is always ſolid in the ordinary heat of our atmoſphere; nor is this laſt

* Let not the reader forget that I am not ſpeaking of the *ſpruce* ſtrictly ſo called, but that ſpecies of *fir* vulgarly called *ſpruce-fir, pine-fir,* &c. diſtinguiſhed by the name of *epicea* by the French.

contained

contained in ſmall bags in the bark, like that above mentioned, nor in the body of the wood like the *larix*, but is found only to flow out from between the bark and the wood.

The peaſants, therefore, in order to obtain it, cut out a part of the bark at the beginning of the ſeaſon (the month of April or May) without hurting the wood; and leaving it in that condition at that time, return at the end of a few weeks, and find the whole wound covered over with a cruſt of ſolid roſin, which had there concreted as ſoon as it flowed out and was expoſed to the air; this they ſcrape off into a baſket, and having pared away a little more of the bark round the edges of the wound, to keep it freſh, leave it in this ſtate for as long a time.

In this manner they proceed during the whole ſeaſon; at the end of which they put the whole into large caldrons, with

with a little water, and melting it ſlowly, by means of a gentle fire, pour it into ſtrong bags of cloth, and while it is yet warm and fluid, put it under the preſs, which ſqueezes out the roſin, and ſeparates it from all impurities; after which it is barrelled up for ſale. The ſubſtance which is obtained by this operation is of a yellowiſh colour and ſolid conſiſtence, turning ſoft in a gentle degree of heat, and is well known in Britain by the name of *Burgundy pitch*. An oil is alſo extracted from this, which is ſold by the name of *oil of turpentine*, but much inferior in quality to that obtained from the *ſilver-fir*.

The roots, if bare, afford a roſin of the ſame quality, and in the ſame manner as the trunk: and it is obſerved, that ſuch trees as are planted in a rich ſoil afford more roſin than thoſe that are planted upon a poorer; and more is got in a warm dry ſeaſon, than in one that is cold and wet.

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The trees of this claſs yield ſome roſin when very young, and always continue to do ſo till they begin to decay by age: but it is remarked, that what is gathered from young trees is ſofter than what is obtained from thoſe of a greater age, altho' it is never entirely fluid. A healthy tree in a good ſoil will yield thirty or forty pounds of roſin each year *; ſo that the

* It is upon the credit of Mr Du-Hamel that I mention this produce. If this is ſo, the profit from an acre of ground behoved to be very conſiderable. I am not much acquainted with the value of this ſubſtance, but have been told it uſually ſells for about ſixpence *per* pound. But let us ſuppoſe it to be worth only twopence, and each tree, at a medium, to yield only twenty pounds in a ſeaſon, worth 3 s. 4 d.; as a Scots acre would contain about 450 trees, if planted at twelve feet from each other, the value of the roſin, at the above rate, would amount to 75 l. ſterling *per annum*; nor could the expence attending this be very conſiderable, one man being ſufficient to take care of upwards of a thouſand trees. I am far from thinking that the profits could be ſo great as this; but as Mr Du-Hamel is a man of character, it is obvious the profits muſt be very conſiderable. I meet with no eſtimate of the quantity of roſin afforded by the *ſilver-fir*.

profit

profit ariſing from this muſt be very conſiderable.

The *ſilver-fir* is not in the leaſt damaged by having its roſin taken from it: but as the rain and ſnow enter the body of the *ſpruce* at the large wounds made in the bark, it in time impairs the wood a little, though ſlowly; and if the tree is not ſo far damaged as to make the wood turn red, it is as good for every purpoſe as before the roſin was extracted from it. Thus it appears, that a plantation of theſe two kinds of trees might be made to turn out to good account, even in ſituations where the wood could be of little value; and it is more than probable, that either of theſe kinds of trees would afford *tar* as well as the *pine*, although I do not know that ever it has been tried. They likewiſe afford an excellent charcoal. In my next, I ſhall ſhew the various uſes that may be made of the *pine*. AGRICOLA.

LETTER SEVENTH.

Of the Pine-tree—*Method of extracting its* Roſin—*Manner of making* Tar, &c.

SIR, *July* 18. 1771.

HAVING pointed out the uſes to which the *fir-tree* might be applied, it would be improper not to mention the ſubſtances that may be drawn from the *pine*, which are not perhaps of leſs value than thoſe extracted from the *fir*.

The *pine*, as well as the *fir-tree*, affords a reſinous juice, although of a different nature in itſelf, and muſt be gathered after a different manner. This juice is neither collected in reſervoirs in the body of the tree, like the *larix*; nor in cavities in the

the bark, like the *fir*; nor does it ooze out only between the bark and the wood, as in the *ſpruce*; but it is diſperſed through the whole body of the wood, and flows forth from any freſh wound that may be made in the body of the tree in a ſemi-fluid ſtate, which it in ſome meaſure loſes when expoſed to the air, becoming gradually of a thicker and more ſolid conſiſtence. This being the caſe, the moſt proper method of collecting the roſin is as follows:

About the month of May, when the ſap begins to flow in abundance, thoſe who make it their buſineſs to gather this roſin, make choice of a proper tree, and having firſt taken off a piece of the outer bark about a foot ſquare near the root, they then cut off, with a very ſharp inſtrument, about four inches ſquare of the inner bark, piercing through it a little way, ſo as to take off with it a thin paring of the

wood. As ſoon as it is made, the reſinous juice immediately begins to ooze out through the pores of the wound, and drops down, in the conſiſtence of a thickiſh balſam, from the under part of it, into proper veſſels placed below to receive it; but as the edges of the wound ſhrivel up, and the pores are quickly contracted when expoſed to the air, ſo as to prevent it from flowing out with eaſe, it is neceſſary to refreſh theſe wounds once every ten or twelve days, by cutting a thin ſlip of the wood and bark from the two ſides and top of the wound, and likewiſe a very thin paring of wood from the whole inner ſurface thereof, which allows the juice to flow afreſh as well as at the beginning. By repeating this operation from time to time, during the ſummer months, the hole becomes larger and deeper; ſo that, by the end of the ſeaſon, it is uſually about an inch or two deep, and

and twelve inches ſquare, ſo as to occupy the whole of the ſpace that was at firſt ſtripped of its outer bark. The next year after this, they make a freſh wound of the ſame ſize immediately above the old one, (for it is obſerved that the juice always deſcends), and manage it in the ſame way as the former one; and ſo on they proceed, making a new wound each year immediately above the old one, till they are as high as they find convenient; after which they begin again near the root in another part of the tree, and carry up another row of openings of the ſame kind; proceeding in this manner round the whole circumference of the tree, if it continues ſo long in health, or affords a quantity of roſin worth the expence.

I need hardly obſerve, that they empty the veſſels which are placed at the trees from time to time, and carry it home, to be

be kept all together till they have gathered all that they can get for that ſeaſon. After the whole quantity is collected, they filtre and barrel it up for ſale in the form of a very thick reſinous baiſam, which is uſed by ſhip-builders for different purpoſes; and in this ſtate it is known in France by the names of *Galipot* and *Perinne*; but I am unacquainted with the name by which it is known in England. In ſome caſes, it is boiled in large caldrons, till it is ſo far inſpiſſated as to be of a ſolid conſiſtence when cold, and is, in that ſtate, put into barrels, and employed by the ſhip-builders for different purpoſes: and ſometimes it is mixed with a little water, and ſtrongly ſtirred and mixed together, which changes it from a dark to a whitiſh colour, ſomewhat reſembling wax, which forms the ſubſtance commonly ſold in the ſhops by the name of *Roſin*. There may likewiſe be extracted from

from it an eſſential oil by diſtillation; but it is ſo much inferior in quality to that obtained from the fir or larix, as to be but little regarded. It is known in France by the name of *Eau de raſe*.

Theſe are all the ſubſtances which have been hitherto extracted from the *pine* by inciſion, in ſuch quantities as to form any ſort of manufacture. But it is not to be expected, that, among the great diverſity of trees belonging to this claſs, there ſhould be no diverſity in the nature of the juices that they afford, or the quantity they produce; but as I have not been able to get diſtinct information concerning this head, I muſt content myſelf with informing the reader, that it ſeems to be agreed, that the large pine, with eatable fruit, is improper for theſe purpoſes: and I much doubt if the *Scots fir* would anſwer well. The kinds which are chiefly employed in France and Spain, for theſe purpoſes,

purpoſes, are the *Pinus maritima major*, DOD. *vel pinus maritima prima*, MATH. and the *pinus maritima minor*, C. B. P. It is very probable, that ſome of the American pines, as yet but little known, might afford other kinds of roſin, or balſam, perhaps in greater quantity, or of a finer quality than that above deſcribed; particulary Lord Weymouth's pine, which diſcovers ſome veſſels like veins in the bark, filled with a fine reſinous juice, the uſes of which have not as yet been diſcovered.

Although the pine-tree will yield ſome reſinous juice when very young; yet they ſeldom begin to extract it from them till they are eighteen or twenty years of age; for they are obſerved to periſh very ſoon if they are opened before that period. Such trees as grow upon rich ground yield more juice than theſe that grow upon a dry barren ſoil, although the wood

is of an inferior quality. A healthy pine, of a proper age, will yield twelve or fifteen pounds of roſin each year *, and, if properly managed, may continue to do ſo for fifteen or twenty years: nor is it found that the wood of the tree is rendered worſe for having the roſin extracted from it, ſo that it may be then cut down, and employed for the ſame purpoſes as if it had remained untouched.

It is from the pine only that *tar* is extracted; and the ſame kind of tree which affords the roſin, by a different proceſs, affords this viſcid, oily, empyreumatic ſubſtance, of ſuch extenſive uſe in many arts and manufactures; but although the ſame trees afford both theſe ſubſtances, yet it is found by experience, that ſuch as have grown upon a dry, warm ſoil,

* Suppoſe twelve pounds each tree, at 1 d. *per* pound, this, for 450 trees, amounts to 22 l. 10 s. *per* acre *per annum*.

and have a firm reddiſh wood, afford the greateſt proportion of tar; whereas thoſe which grow upon a rich ſoil, and have a ſoft ſpungy wood, yield the greateſt quantity of roſin: therefore a dry barren ſoil will be moſt proper in general for the manufacture of *tar;* whereas one of a richer nature will afford a greater quantity of roſin: but theſe two manufactures ought ever to go hand in hand, and on no account be ſeparated from one another, for many obvious reaſons.

Either of theſe kinds of wood afford a good charcoal; and as it muſt be *burnt* before either the tar or charcoal can be produced, they are often both obtained by the ſame operation; but, according as the one or the other is the principal object attended to, the operation muſt be a little varied.

If the ſituation is ſuch as to make the tar the principal object of concern, then

then it is proper to ſplit the tree, cutting away the outer white wood, and only taking the parts which are red, and full of a fatty reſinous juice, particularly the knots and excreſcences where branches have been cut off; and if the manufacture of roſin is carried on at the ſame place, the then laminæ, cut off to refreſh the wounds, ought to be carefully preſerved, as they afford a great proportion of tar. Theſe picked pieces, when properly conſumed, yield a very large proportion of tar of the very beſt quality, uſually about one-fourth of the weight of the whole wood put into the furnace; but if the charcoal becomes an object of conſideration, then all the parts of the trunk are employed indiſcriminately, as well as the branches; and even the roots are employed for this purpoſe, as they are found to yield it in conſiderable quantities, eſpecially thoſe of the trees that have previouſly af-

forded roſin; as the workmen in *Provence* always imagine that theſe yield a larger proportion than thoſe of other trees.

In all caſes, it is eſſentially neceſſary for this operation to have the wood about half dried; therefore the workmen continue to fell the trees the whole year round, in proportion as they need them; and when they are of a proper degree of dryneſs, they are brought to the places where they are to be burnt; there they are cut into lengths proportioned to the ſize of the kiln; and the trunk and large branches are divided into ſmall billets of an inch or two ſquare.

The kilns in which they are burnt are of different forms and ſizes in different places; but the moſt uſual form is that of an egg placed upon its great end, and the ſize from five to ten feet in height, with other dimenſions in proportion to the height. The under part of the kiln

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is always made of hewen ſtone, and the very baſe uſually conſiſts of one ſtone hollowed out in the inſide, ſo as to reſemble the ſhape of the under part of an egg. About ſix inches above the loweſt part of it, on one ſide is made a hole ſlanting downwards a little, into which is fitted a piece of an old gun-barrel, or other hollow cylinder of iron; and a little above that is placed an iron-grate. The hewed ſtones uſually reach about one third of the whole height; and above that it is formed of brick or ſtones, cemented with well-wrought clay, and cloſely and compactly built.

When the whole is ready, and the wood cut, it is put into the kiln, laying one ſtratum of the billets acroſs the grate, and another acroſs theſe, and ſo on to the top; taking care to arrange them as well as poſſible, ſo as that no vacancies may be left. When it is filled to the top, a few billets

billets of dry wood are put upon it; and over the whole is placed ſome flat ſtones made on purpoſe, which join cloſe together, and ſupport one another, leaving only a ſmall opening at the top, of five or ſix inches diameter: it is then lighted at the top; and when the dry wood is ſufficiently kindled, a flat ſtone is applied to the opening, ſo as to damp the fire, and make it burn ſlowly: for upon this article, in a great meaſure, depends the ſucceſs of the operation. The workmen by habit acquire in time a great degree of accuracy in this reſpect; and when they ſee it burning too quick, they cover the joinings of the ſtones with wet earth, which they take care to have ready at hand for that purpoſe, and in this manner regulate the fire till the whole of the tar is extracted; after which they cover the whole quite cloſe up till the fire is extinguiſhed; and when it

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is cold they take out the charcoal, and begin the ſame operation anew.

During the courſe of the foregoing proceſs, the tar (which is compoſed of the roſin and ſap of the tree, melted by the heat and mixed together) is forced to drop down from the pieces of wood below the fire, and falls to the bottom; and after having riſen as high as the hole in the bottom of the kiln, it then flows out of the tube into veſſels placed without the kiln to receive it; from whence it is taken, and put into barrels for ſale. When they open the furnace, they take care to collect all the ſoot which is found ſticking to the flat ſtones on the top, as well as on the inſide of the kiln, and put it into ſmall barrels for ſale; this being the well-known ſubſtance called *lamp-black*.

From a ſlight review of this article, it will appear obvious, that few trees afford a greater variety of uſeful products than the

the *pine;* for, beſides the value of the wood, which is conſiderable where there is conſumpt for it, the ſame tree may be ſucceſſively made to yield *roſin*, *tar*, and *pitch*, *lamp-black* and *charcoal*.

I have never heard that tar has been extracted either from the *fir* or *larix*, although, as I have already obſerved, from the reſinous nature of theſe trees, it ſeems probable that both of them might be made to afford it in as great quantities as the *pine:* nor have I been able to learn, whether any of the different kinds of pines are incapable of being made to yield this ſubſtance in abundance; and in particular, whether the *Scots fir* would be proper for this uſe or not.

AGRICOLA.

LETTER

LETTER EIGHTH.

The Method of making Pot aſh.

SIR, *July* 25. 1771.

IN my former letters, I hope I demonſtrated pretty clearly, that there are few ſituations ſo unfavourable, in which ſome advantage might not be made of a plantation of ſome of the *coniferous* trees; but as theſe plantations in a ſhort time decay, and need renewing, I ſhould think that I left the ſubject unfiniſhed, if I did not point out ſeveral other products which might be drawn from other kinds of trees, of which conſiderable profit might be made even in the moſt remote ſituation.

Where wood can neither be ſold in ſubſtance, nor any advantage be made of it when reduced to charcoal, we have it ſtill in our power to extract from it that uſeful alkaline ſalt, known by the name of *potaſh*; which is of ſuch a value as eaſily to bear the expence of carriage from the moſt remote and inacceſſible part of our iſland, to the places where it may be ſold, and for which there is ſuch a conſtant encreaſing demand, as prevents us from having the ſmalleſt fear of ever being able to overſtock the market; but, on the contrary, as this is an article ſo eſſentially neceſſary for carrying on the ſtaple manufacture of this part of the kingdom, there is greater reaſon to dread the want of a ſufficient quantity to anſwer all our purpoſes: For ſhould any miſunderſtanding ever ariſe between us and thoſe kingdoms from whence we are at preſent ſupplied with this article, it is difficult to point out all

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the bad effects that might accrue to the nation on that account. Or even ſuppoſing that this ſhould not be the caſe, yet it is not to be expected, but that thoſe who furniſh us with it, will, ſooner or later, perceive, that it is an article that we *muſt* have, and conſequently they will raiſe the price of it as high as they pleaſe, (as it is well known the Dutch practiſe every day with regard to flax), which would produce a miſchief of ſuch a ſerious nature, as ought ever to be guarded againſt with the utmoſt care, and therefore deſerves the attention of every well-wiſher to his country. Now, as it is certain, that Scotland might eaſily produce as much pot-aſh as would not only be ſufficient to anſwer all the purpoſes neceſſary for carrying on its own manufactures, but alſo ſupply all England and Ireland with this commodity, if one hundredth part of the ground proper for this purpoſe were ap-

propriated to that uſe, I muſt again recommend this ſubject to the attention of thoſe gentlemen whoſe eſtates lie in the inland and mountainous parts of the country, which are on that account incapable of any other improvement; and beg of them to make ſuch plantations as their ſoil, ſituation, and conveniency, may point out as proper; in the full confidence that this will more effectually improve their eſtates, and better their fortunes, than any other plan which they could poſſibly adopt.

It is found by experience, that almoſt every tree, when *properly* reduced to aſhes, will afford a certain proportion of this alkaline ſalt; but ſome yield it in much larger proportions than others. The reſinous trees are, of all others, the moſt improper; which is the leſs to be regretted, as we have already ſeen that they can be of uſe in another way. Almoſt

moſt all the other trees, commonly known by the name of *barren timber*, yield it in conſiderable proportions; but the *beech* is eſteemed the beſt of all for this purpoſe; and next to that the *hornbeam*. I cannot pretend to point out exactly the order in which the other trees do follow theſe in this reſpect, not having any books at hand which could direct me in the ſearch: but ſuch of your readers as have an inclination to be better informed concerning this article, may, if they chuſe it, have recourſe to a curious memoir on this ſubject, written by Mr *Geofrey*, and publiſhed in the Memoirs of the Royal Academy of Sciences at Paris, ſome time between the year 1715 and 1720, or about that period. I, for my own part, am but little anxious about the reſult of this inquiry, being fully perſuaded, that no tree which can be named could be preferred to the *beech*; as few, if any, trees thrive ſo well

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as this on dry mountainous ground, in an expoſed ſituation; grow ſo quickly, or arrive at ſuch a magnitude: On all which accounts, it is the moſt proper tree that could be deviſed for this purpoſe. And, from my own experience, I can aver, that it thrives remarkably well when planted among any trees of the coniferous tribe; among which it ought always to be planted, if it is intended for this uſe; becauſe, while *it* is advancing in magnitude, the *fir* would yield its roſin; and when they arrived at a conſiderable ſize, ſo as to be crouding one another too much, it would be time to cut out the reſinous trees for making tar, which would give the beeches room to grow; and by the time that the whole of the reſinous trees were felled, they would be arrived at a great ſtature, and fit for making *pot-aſh*.

But although I recommend the beech-tree ſo much for this particular purpoſe, let

let the young planter obſerve, that this is the only caſe in which this tree can be planted, ſo as to become more valuable than any other; becauſe, on account of its brittle quality, the wood of the beech-tree is not of ſuch value for almoſt any mechanical purpoſe as ſome other trees; the aſh and elm being tougher where ſtrength and elaſticity are required, and the oak and hornbeam harder, as well as tougher, than it is.

The only art neceſſary in making *pot-aſh* is, to conſume the wood with as little flame as poſſible, until it is reduced to aſhes. For this purpoſe, it is neceſſary to have a kind of kiln, ſomewhat reſembling that which is employed in making tar, already deſcribed; only it muſt have air admitted during the operation, and therefore it muſt not only be more open at top, but alſo muſt have an opening below, with a door to ſhut or open at pleaſure, as circumſtances

cumſtances may require. For if too little air is admitted, the wood would only be reduced to a charcoal, and not to aſhes; and if too much is admitted, ſo as to make it flame vigorouſly, it is found that the alkaline ſalt is in a great meaſure diſſipated during the operation, ſo that the aſhes thus obtained yield little or nothing. The whole nicety of the operation, therefore, depends on admitting juſt enough of air to conſume the wood ſlowly, and reduce it to aſhes, and no more.

After the fire is extinguiſhed, the aſhes are collected, and put into tall cylindrical veſſels, and tramped quite cloſe. Theſe veſſels are then placed above one another; the bottom of each being pierced full of ſmall holes, or made of baſket-work, to allow it to filtre freely. Water is then poured gently upon the uppermoſt, which ſinks gradually among the aſhes, and in its courſe diſſolves and carries along with it the alka-

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line ſalt with which the aſhes were impregnated; and having paſſed through the uppermoſt veſſel, it falls into the ſecond, and carries off a greater portion of alkali; and ſo on to a third, or fourth, or more, till, upon trial, they find that their *lie*, as it is now called, is of a ſufficient degree of ſtrength. Freſh water is ſtill poured upon the aſhes, till it comes from the firſt veſſel pure and taſteleſs, which is then removed, and the ſecond becomes the uppermoſt; another freſh veſſel being placed below inſtead of the one that is removed; and when the ſecond tranſmits the water pure, it is removed in its turn, as is the third and fourth; and ſo on *ad infinitum*.

The lie being thus obtained of a ſufficient ſtrength, may be employed without any further operation, if a manufacture of ſoap, or any other in which this ſalt is employed, be carried on in the neighbourhood; but if it is to be tranſported to a

diſtant market, it is neceſſary to reduce the ſalt to a ſolid ſtate, by evaporating the water from it. Many contrivances have been fallen upon to facilitate this operation, which it would be ſuperfluous for me here to enumerate, as it is univerſally allowed, that the beſt method is to boil it ſlowly over the fire in the ordinary way, till the moiſture is all exhaled; and when the ſalt is dry, barrel it cloſe up immediately, before it can have time to imbibe the moiſture from the air, which it always does with great avidity.—Such is the operation for obtaining this uſeful ſubſtance; by means of which, wood, in the moſt inacceſſible corner of the country, may be made to turn out to great account. If this account ſhall induce any, whoſe intereſt it may be, to turn their attention to this ſubject, it will give a ſenſible pleaſure to

AGRICOLA.

LETTER

LETTER NINTH.

Of the Sugar-maple—*Method of extracting its Juice; and of other Saccharine Juices of Trees.*

SIR, *Auguſt* 1. 1771.

FEW ſubjects afford a more ample field for contemplation, or a more innocent recreation for the mind, than the ſtudy of the nature and properties of the vegetable kingdom. Chance has diſcovered ſome of the properties of theſe, and the invention of man hath been able to turn ſome of thoſe diſcoveries to the moſt valuable purpoſes in life; yet when we examine this ſubject with attention, it

does not ſeem to be exhauſted, as we find many objects relating to it, which bid fair for being extremely uſeful to mankind, that have never yet been examined at all. If we look around us in the world, and compare different countries with one another, and with ourſelves in this reſpect, we will ſoon diſcover, that, on many occaſions, one nation, or even a part of a nation, employs, for the moſt valuable purpoſes in life, certain trees or plants which are neglected and deſpiſed by others, although the ſubjects which afford them are daily before their eyes and in their hands. How many countries in Europe are deſtitute of many of the vegetable products I have mentioned in this ſeries of letters, and are obliged to import them, at a conſiderable expence, from others, while the very trees that afford them are rotting at their doors, and little or no uſe is made of them? After this, need we be

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ſurpriſed to find, that ſome countries ſhould produce vegetables which may be poſſeſſed of ineſtimable properties, of which the inhabitants, or even the whole world, may as yet be entirely ignorant? How long was mankind acquainted with the ſugar-cane before they knew all the valuable ſubſtances that might be extracted from it? and how many nations at this day produce the moſt excellent grapes, of which the inhabitants know no other uſe but to employ them as a refreſhing fruit? Even the Chineſe themſelves, who boaſt ſo much of their inventions, and excel in ſeveral *other* arts, although as fond of the fermented juice when it is given them as any of their neighbours, and although they have the fruits which afford it growing to perfection in every corner of their country, are to this hour ignorant of the manner of making wine for themſelves, although the miſſionaries have made it among

among them for near two hundred years.

Seeing then that this is the caſe, even with regard to things whoſe qualities have been already diſcovered, and that mankind are ſo ſlow in adopting leſſons which are given them by others, can we be ſurpriſed if they have totally overlooked many qualities which trees and other plants may as yet be poſſeſſed of, about the nature of which we may now be totally ignorant, although time may perhaps, on ſome future occaſion, diſcover them to ſome diligent inquirers? It is therefore our duty, as reaſonable beings, to pay ſome attention to the objects which are daily under our hands, and endeavour to diſcover the properties of which they may be poſſeſſed, by trying ſuch experiments as we eaſily can upon theſe ſubjects which have not hitherto been ſufficiently examined; but eſpecially upon thoſe, which, from any ſort of analogy with

with others whoſe properties may be already known, give us the faireſt proſpect of ſucceeding.

I might point out many ſubjects in the vegetable kingdom, which would merit our particular attention; but as I have all along confined myſelf to the produce of *barren timber* alone, I ſhall not here conſider any other vegetable whatever. It is well known, that ſome trees yield a juice, when properly treated, which is of conſiderable value, and much eſteemed by thoſe who are acquainted with it; and as this is the caſe with ſome trees, whoſe external appearance denote nothing particular, this naturally might make us imagine, that it is poſſible the juices of ſome other trees might be of uſe in the ſame or ſome other reſpect; and as the experiment can be tried with ſo little trouble or expence, we would naturally have imagined, that a very few years after the diſcovery of this property

property of the juice of ſome trees, the qualities of the juice of every tree produced in this country, and the various uſes to which it might have been applied in medicine or arts, would have been ſufficient to have aſcertained, with the utmoſt preciſion; and yet the reader muſt be conſcious to himſelf, that unleſs it is the *ſugar-maple* and the *birch-tree*, he has hardly heard of any other that ever has been examined with this view. And as it is poſſible he may not even have heard of theſe, or may not perhaps have heard diſtinctly of the manner in which they are extracted, or the uſes to which they may be applied, I ſhall briefly explain a few of the particulars relating to it which have come to my knowledge.

There is found in North-America a certain ſpecies of maple, upon which the natives have beſtowed the name of the *ſugar-maple*, becauſe from it they extract a juice which

which yields a perfect ſugar when evaporated, which the inhabitants of Canada employ for every purpoſe that would require ſugar, and for many uſes prefer it even to that extracted from the ſugar-cane. The method of obtaining the juice, and preparing the ſugar, is as follows.

The Canadians extract this juice from two kinds of maple, one of which greatly reſembles our *plane* or *ſycamore*, which is likewiſe known by the name of *plane* with them; the other has a ſmaller leaf, more reſembling that of the leſſer maple, and is called by them the *ſugar-maple*. They diſtinguiſh the ſugar made from theſe two trees, calling one the ſugar of *maple*, and the other the ſugar of *plane*. The juice is obtained from both of theſe trees by the ſame operation; which is by boring a hole in the under part of the tree, penetrating into the heart of it, and ſlanting a little upward, that the juice

may flow out of it with the greater eaſe; and at the mouth of the hole they fix a chip of bark, or ſmall wooden funnel, to direct it into a veſſel placed below to receive it.

As it is found by experience, that the tree affords no juice in the ſummer-ſeaſon when in full ſap, it being always obſerved to ſtop from flowing when the buds begin to ſwell, and the bark ſeparate from the wood, they make their inciſions during the winter-ſeaſon, between *November* and *May*. But as the winters are exceedingly ſevere in that climate, and as they obſerve that the tree yields no juice but during the time of thaw, they generally obtain very little till the firſt of *March*; on which account many of them do not make the holes in the trees till that time: and as it always yields moſt juice when the weather is warmeſt, they uſually make theſe holes upon the ſunny-ſide of the tree.

From

From the beginning of *March* till the middle of *May* is the principal ſeaſon for collecting this juice; and during that time it often flows in ſuch abundance as to run in a continued ſtream, which is ſometimes as large as would fill a writing-quill, and will fill a *Paris* pint-jug in a quarter of an hour: from whence it may be in ſome meaſure gueſſed what quantity will be yielded by one tree in a ſeaſon, and the ſugar that may be extracted from it, as it is uſually computed that twenty pints of juice will yield a pound of ſugar *.

The

* If, with a view to make a calculation of the profits that might be reaped from this article, we ſuppoſe, that inſtead of running one pint in a quarter of an hour, it ſhould at a medium run only one pint in four hours, this would be ſix pints in twenty-four hours; and if we ſuppoſe that the ſeaſon for collecting it ſhould only be ſixty, inſtead of ſeventy-five days, the whole quantity collected in a ſeaſon from one tree would be 360 pints, which, at the ordinary proportion, would yield eighteen pounds of ſugar, which, at 6d. *per* pound, amounts to 9s. ſterling.

The juice, as it flows from the tree, is clear and limpid as the pureſt water, cool and refreſhing to the taſte, leaving upon the palate an agreeable ſweetiſh taſte, that from the maple being *ſweeter* than the *plane*, but the juice of the plane more *agreeable* than that from the *maple*. If the juice is drank as it comes from the tree, it is extremely wholeſome, never occaſioning the ſmalleſt inconvenience, not even when drank by a perſon extremely warm,

Now, as an acre of ground will contain 540 trees, if planted at ten feet diſtance from each other, if we were to ſuppoſe that each of theſe ſhould yield the ſame, the value of an acre would be 243 l. ſterling *per annum*; but if it ſhould be thought that theſe trees would be too cloſe upon one another, on that account we ſhall ſuppoſe them planted at the diſtance of twenty feet; ſtill the value in this caſe would amount to upwards of 60 l. ſterling *per annum*; which is a profit ſo immenſe as can ſcarce be believed poſſible; yet as the above facts are related by Mr *Du-Hamel*, (ſee his *Traite des Arbres et Arbuſtes*, article ACER), it muſt be ſuppoſed that they are founded upon facts, and clearly prove that the profit might become very conſiderable.

and

and covered over with ſweat. Towards the end of the ſeaſon, however, when the ſap begins to aſcend, this ſugary juice acquires a kind of herbaceous taſte, which renders it far leſs agreeable; nor is it ſo eaſily evaporated to dryneſs as before, and therefore ought to be ſet apart for inferior uſes.

After a ſufficient quantity of this juice is obtained, it is put into large caldrons, and boiled upon the fire, to evaporate the moiſture; the perſon who has the charge of it being very careful to ſtir it during the whole time; but more eſpecially towards the end of the operation, to prevent it from acquiring a burnt taſte, which it moſt certainly would do if this operation was omitted: they likewiſe take care to ſkim off from time to time any impurities which may ariſe on the ſurface. When it hath acquired the conſiſtence of a thick ſyrup, it is taken from the fire, and put into

into moulds, in which it gradually hardens as it cools, and becomes at length a reddiſh brown ſugar, extremely agreeable to the taſte, if it has not been too long kept upon the fire during the operation; but if that has been the caſe, it acquires a taſte ſomewhat reſembling that of melaſſes, which is far from being agreeable.

As I once obtained a ſmall quantity of this ſugar, by the favour of a friend who came from Canada, I doubt not but your readers will be better pleaſed with a deſcription of that as it appeared to me, than any other that I might copy from other writers. It was in the form of a pretty large thin cake, of a reddiſh brown colour, and ſemi-tranſparent; in this particular nearly reſembling brown ſugar-candy; only it was of an uniform texture throughout, and much ſofter, and more unctuous to the touch than any kind of ſugar with which I am acquainted: it is likewiſe

extremely

extremely apt to attract moiſture from the air, ſo as readily to *deliqueſce*, or run into a ſyrup, if not kept in a very dry place; but the ſyrup is not ſo adheſive or *gluey* as that of common brown ſugar; and the lumps are eaſily broken, like ſugar-tablets. With reſpect to taſte, it ſeems to have far leſs of that acid quality which affects the throat with a ſort of fiery roughneſs, than any other kind of ſugar; being more mild and bland, and having a moſt agreeable balſamic ſweetneſs. It is greatly recommended in all the places where it is known, as of great uſe in colds, being extremely mild and ſoftening for the breaſt. I employed it for that purpoſe with myſelf and ſome others, and all of us thought that it well deſerved the character it had obtained; but whether our imagination might not, on account of its novelty, help to make us attribute to it greater effects than it really deſerved,

deſerved, I will not pretend to ſay: at any rate, I think it is fully *as* agreeable as any other kind of ſugar; and if it were refined, it would probably be more ſo, the inhabitants in that country being content with it in its firſt ſtate, without ſeeking to refine it, excepting that in ſome caſes they clarify the ſyrup with whites of eggs, which renders it more beautiful and pleaſant.

A tree will continue to yield juice for a very long time, without being in any meaſure hurt by it, if only one hole is made at a time; but if too great a number are opened at once, it hurts the tree a good deal, and ſometimes makes it even periſh entirely. It is always neceſſary to make a freſh hole each year, as there is never any juice flows from it but that year when it is made. Young trees afford a greater *quantity* of juice, but that obtained

from

from old trees is of a richer *quality*, and yields a greater proportion of ſugar.

Such is the method of obtaining, and ſuch the quality of the juice of the maple. With regard to the birch, it yields its juice in the ſame manner as the other; but I never have heard that ſugar has been hitherto extracted from it. Whether this is becauſe it is incapable of being made to yield this, or becauſe it never hath been fairly tried, I cannot ſay, as I myſelf have never had an opportunity of examining this ſo particularly as the importance of the ſubject would ſeem to deſerve. But however that may be, it is certain that it has been hitherto only employed as a pleaſant cooling drink, which almoſt every one who has ever taſted it is exceedingly fond of, deſcribing the taſte of it nearly in the ſame terms as the Canadians deſcribe that of the maple-juice, ſaying, that it has a pleaſing ſweetneſs,

with a refreſhing coolneſs, ſo as to be as agreeable as can well be imagined.

I have not heard that either the *birch-wine*, (as it is commonly called), or the maple-juice, has ever been fermented, although there is the higheſt probability that either of theſe would afford a vinous liquor of a very refreſhing kind, if they were ſubjected to this operation; nor can there be any doubt, but that they would be ſuſceptible of fermentation by a proper management, as it is now ſufficiently well known, that every *ſaccharine* juice is naturally diſpoſed to run into the vinous fermentation, if put into proper circumſtances. I would therefore recommend it to thoſe who may have a proper opportunity of doing it, to try this, ſeeing it is ſo highly probable that they may thus obtain a wine of a very pleaſant kind, at a very moderate expence. The probability indeed is, that this juice would be ſo much

much diluted as to be incapable of affording a wine of a ſtrong body; but this defect might be in ſome meaſure remedied, either by boiling the juice for ſome time before it was fermented, or by adding a little ſugar to it to render it richer, which ſeems to be the moſt eligible method; as it is always found, that much boiling checks fermentation extremely on all occaſions. Where a more ordinary ſort of drink were wanted, it might be made by the help of a little melaſſes, or even malt, in very ſmall proportions, might be employed for the ſame purpoſe.

It is a pity that we are as yet ſo little acquainted with the ſugar-maple of America; and it were to be wiſhed, that thoſe perſons who are employed to collect American ſeeds for ſuch gentlemen as ſubſcribe for that purpoſe, were ordered to ſend over a much larger quantity of the ſeeds of this and other uſeful trees, than they

uſually do, which would be of greater utility to the nation than that indiſcriminate method that ſeems to be obſerved at preſent by thoſe gentlemen, who ſeem to ſend as large quantities of the ſeeds of uſeleſs, as of valuable plants and trees. If this were done, we might, at a very moderate expence, get over ſuch large quantities of theſe ſeeds as would render the trees much more common here than they are at preſent: and as it is not to be doubted but they would thrive, we might in a ſhort time encreaſe them to ſuch a degree as to reap conſiderable advantages from them.

In the mean time, let us try if any other tree can be found which will yield a juice that might be employed for ſimilar purpoſes; and as it is found that trees of the ſame claſs are very often poſſeſſed of ſimilar qualities, let us begin our experiments with the common maple, uſually called

plane-

plane-tree, and the *alder* or *aller*, as it is commonly called. The firſt of theſe is ſo nearly allied to the maple, as to render it extremely probable that it will yield a juice in ſome reſpects reſembling it; and the ſecond being of the ſame family with the *birch*, may very probably be poſſeſſed of virtues ſomewhat ſimilar to it *. Next to

* I never have heard that any experiment has ever been made upon the juice of the *alder*; but I find, by conſulting ſome old writers, that the juice of the *plane-tree* has been ſometimes tried with this view, and found to be fully as good as that of the birch-tree. As I had an opportunity laſt ſpring, I cauſed one or two ſmall plane-trees to be bored, and obtained from them a conſiderable quantity of the juice, which had a pleaſant ſweetiſh taſte as it came from the tree. I evaporated a little of this, which ſoon became as ſweet as a thin ſyrup of ſugar, and was very pleaſant. I intended to have tried to bring it to a ſolid ſugar, to have fermented it alone, and with ſugar, melaſſes and barley, all ſeparate from each other; but being unluckily engaged very much in other affairs, and called from home, theſe experiments were neglected; but from the little that I tried, I had very good reaſon to hope for a favourable concluſion from them.

to theſe the *oak* claims our attention; for every one knows that the leaves of this tree, in the end of May or beginning of June, are very frequently covered over in the morning with a thick clammy ſubſtance, remarkably ſweet to the taſte. Whether the juice would be of the ſame nature or not, experience alone ſhould determine. The *beech* and *elm* ſeem likewiſe to be impregnated with a mild and

A conſiderable quantity of the juice was put by in bottles, which were left unſtopped; and upon examining the liquor now, (June 26.), I find, that inſtead of being vapid or muſty, as I expected, it has now acquired a pleaſant acid taſte; which plainly ſhows that it muſt have undergone the vinous fermentation, although it could not be expected, that in theſe unfavourable circumſtances it could have remained long in the vinous, but muſt have quickly hurried forward to the acetous ſtate. I intend to repeat my experiments next year; and if any of my readers ſhould, from theſe hints, be induced to try the ſame, I muſt caution them againſt uſing earthen veſſels of any ſort for collecting the juice at the tree; for as theſe muſt be left abroad all night, they run a great riſk of being broke if it ſhould come a froſt before morning, as I have experienced to my coſt.

bland

bland juice *, and therefore deſerve our attention. In ſhort, as it is impoſſible *a priori* to determine what may be the caſe with regard to any tree, it is proper that they ſhould *all* be particularly examined; and after this is done in a fair and ſatisfactory manner, we will at leaſt be certain that we do not loſe through negligence any thing that could be of uſe to us: and it is highly probable, that by a

* I am ſenſible that ſome of the trees above mentioned do not bleed in the ſpring when wounded, like the *birch* and *maple*; and therefore their juices, if obtained at all, would require to be collected in a manner different from that which is practiſed with regard to theſe. What that particular method may be, or whether any method already has been, or ever will be, diſcovered for doing this, I cannot ſay; but we have already ſeen, that every one of the coniferous trees affords ſome kind of reſinous juice, although this muſt be extracted from each particular kind of tree by a different proceſs; and it is not impoſſible but that there may be other methods of obtaining the juices from ſome particular kinds of deciduous trees, different from that which has been hitherto practiſed.

careful

careful examination of this ſubject, we might make ſome diſcoveries which would be of real conſequence to ourſelves and the community, of which we are a part; which, if it could be accompliſhed, would afford a ſenſible pleaſure to

AGRICOLA.

*** I find that the Canadians likewiſe obtain a ſugar from a particular kind of *Walnut-tree*. This ought to be an additional incitement to our induſtry.

LETTER

LETTER TENTH.

Of the Bark *of the* Oak, *and other Trees which can be of Uſe in Arts*, &c.

SIR, *Auguſt* 22. 1771.

NOT only the wood, the aſhes, and the native juices, but even the *bark* of trees, is, on many accounts, of ſingular uſe to mankind, and may, on many occaſions, yield a very conſiderable revenue to the planter. Not to mention the different kinds of bark, which are of uſe in medicine or *dying*, I ſhall here chiefly confine myſelf to take notice of thoſe kinds which are employed for *tanning* leather, as this is the only manufacture which

could conſume ſo much as to become of conſequence to the improver.

The only tree, whoſe bark is univerſally employed for this purpoſe, is the *oak*; but there are many others which are uſed for the ſame purpoſe in different parts of the globe; and probably there are many more that might be of great utility in this way, which have not hitherto been examined. I have already obſerved, that the bark of the young *larix* is ſaid to be employed for this purpoſe in thoſe parts of the *Alps* where this kind of tree is moſt commonly cultivated: It is likewiſe aſſerted, that the ſame uſe is made of the bark of the *pine-tree*; and, in ſeveral parts of *Germany* and *America*, it is likewiſe ſaid, that the *ſpruce-fir* is employed for the ſame purpoſes. The ſame may be ſaid of the *alder*, the *ſumach*, and the *coriaria*, or *myrtle-leaved ſumach*, which is eſteemed preferable to the *oak*: but as I have never heard

heard of any of theſe having been tried in this iſland with that accuracy that would be neceſſary, I know not exactly how much credit is to be given to theſe reports. Be this, however, as it may, it is certain, that, in ſeveral parts of Britain, the bark of the *birch-tree* is as conſtantly uſed for tanning leather as that of the *oak*, and ſells at nearly as high a price *; while, at the ſame time that this is done in one corner of our ſmall iſland, the uſe of the bark of this tree is ſo little known in other parts of it, that I ſhould not be ſurpriſed if ſome of my readers ſhould doubt the fact, and laugh at my credulity for believing it; however, if any of theſe ſhould chance to be acquainted with the Earl of *Aboyne*, let them aſk at him, whether he makes any profit from this article; who

* The common price is 10 s. *per* boll, reckoning eighteen ſtone-weight, Amſterdam, a-boll.

will ſoon ſatisfy them of the truth of what I now advance.

It is really ſurpriſing that mankind ſhould, in many caſes, be ſo ſlow to open their eyes to their own intereſt. One would naturally have imagined that the high price of *oak-bark* in this country, and the very great difficulty of procuring it in many places, would have long ago induced ſome perſon of enterprize to have tried if any other ſubſtance could be found that would anſwer as a *ſuccedaneum* to it; but unleſs it be ſome hints that we have lately ſeen in the news-papers, that Dr *M'Bride* in Ireland had made ſome capital diſcoveries on this head, I have never heard that any perſon has attended to it in the leaſt. What theſe diſcoveries of his may be, the public are not as yet informed; but if it be really true that this ingenious gentleman has turned his attention to this ſubject, and ſeriouſly made any experiment

upon

upon it, I have not the ſmalleſt doubt but that he muſt have diſcovered ſome things that would be new to us, and of conſequence to the public, as there is undoubtedly a great variety of vegetables that are poſſeſſed of the ſame quality by which the *oak* becomes of uſe to the tanner; although, perhaps, theſe may poſſeſs it in very different degrees, ſome *more*, and others *leſs* powerfully than the *oak*.

To point out *all* the vegetables which may have a chance of being uſeful in this reſpect, would be, in ſome meaſure, foreign to my preſent purpoſe, as well as beyond my power to perform, ſeeing that I have never been in a ſituation that enabled me to proſecute any experiments on this ſubject; yet, in order to give ſome aſſiſtance to ſuch as may have inclination and convenience to proſecute this ſtudy, I ſhall beg leave to inform them, that there is the higheſt reaſon to think,

think, that the bark of the greateſt number of trees or ſhrubs that are known, might be of *ſome* uſe in this reſpect;—for, as the *oak-bark* is uſeful in tanning, only becauſe of its *aſtringent* quality, which helps to contract the pores of the leather, and make it impervious to moiſture, we may naturally conclude that every other vegetable that is poſſeſſed of an aſtringent quality, will be of uſe in this reſpect, in proportion to its degree of aſtringency; and, as this is a quality for which the *bark* of trees *in general* are peculiarly remarkable (as there are very few which do not poſſeſs it in a leſſer or greater degree), we ought to try to diſcover the degree of aſtringency that the bark of every kind of common tree poſſeſſes, and compare it with that of the oak; which would ſhew at once the comparative value of each of theſe in this reſpect. Now, as it is by means of this ſame aſtringent quality that vegetables become

become fitted to ſtrick a black colour with vitriol of iron, we are furniſhed with a ready mean of diſcovering the degree of this quality by the deepneſs of the colour, that an extract of any bark in water gives, when mixed with a ſolution of vitriol; and may ſafely conclude, that every ſubſtance which can be employed by the *dyer* to produce a black colour, would likewiſe be of very great utility to the *tanner*: And although the *gall-nut*, ſo neceſſary to the dyer, could never be produced in quantities ſufficient to be of any uſe in tanning; yet as the oak-bark, ſo univerſally uſed by the tanner, does not ſeem to be ſufficiently aſtringent for the purpoſes of the dyer, while *ſumach* is every day employed by the latter, we ought to conclude, that this would be of greater power in tanning than the bark itſelf. The ſame might be ſaid of the bark of many other trees, which are found to be uſeful in dying;

ing; ſuch as the *alder*, the leaves and bark of the *walnut*, the *aſh-tree*, the *pear-tree*, and many others, which evidently diſcover, by the ſlighteſt trials, a conſiderable degree of aſtringency, and therefore deſerve to be particularly examined; and among theſe, ſeveral ſpecies of the tribe of *willows* bid fair to hold a diſtinguiſhed place. What a pity is it then, that this uſeful inquiry ſhould have been ſo much neglected? more eſpecially when we conſider, that the method required for aſcertaining the degree of this quality is ſo ſimple, and for the purpoſe of the tanner, at the ſame time ſo exact: I ſay, *for the purpoſe of the tanner, exact;* becauſe, however imperfect every chemical analyſis, even the moſt ſimple, muſt be for diſcovering the medical properties of bodies; which, when applied to the human frame, that wonderful nice machine, compoſed of ſuch an immenſe variety of tubes and

fluids

fluids circulating through theſe, and poſſeſſed of that delicate ſenſibility peculiar to animal life, by which the vital powers are often diſturbed from cauſes imperceptible even to the ſenſes themſelves; when theſe, I ſay, are applied to this exceeding delicate frame, their latent and imperceptible qualities very often diſturb the animal œconomy ſo much, as to counterbalance the effects which we might have expected from their other more powerful and perceptible properties. But, however cautious the *phyſician* ought to be in truſting to his experiments, it ſeems probable that the *tanner* may proceed with greater boldneſs and confidence; for as all his operations are confined to the lifeleſs animal fibre, which is incapable of any degree of irritability, he may rationally conclude, that it can only be by the moſt ſtrong and obvious properties that they can produce any effect at all; and that

the more latent and imperceptible qualities which they may be poſſeſſed of, may be in a great degree, if not entirely, diſregarded by him, ſo that he may in a great meaſure reſt ſatisfied, that ſuch ſubſtances as diſcover the marks of aſtringency by the uſual chemical teſts applied for this purpoſe, will be uſeful to him in proportion to the degree of it which they diſcover.

With this view, then, let him take a ſmall quantity of the dried bark of the oak, and an equal quantity of the dried bark of any other tree that he would wiſh to examine; infuſe each of theſe for an equal length of time in an equal quantity of water taken from the ſame place; then take an equal quantity of each of theſe ſolutions, and put them into tranſparent glaſs-veſſels of the ſame ſize and form, and dropping into each of theſe a drop or two of the ſolution of green vitriol, if they

they are poſſeſſed of any degree of aſtringency, it will be immediately changed into a bluiſh-coloured liquor, and the deepneſs of the tinge which each takes will in ſome degree point out the proportional aſtringency of each.

After he has thus diſcovered which of them promiſe beſt, he may then try them upon leather; and a very little attention will diſcover whether they will anſwer his purpoſe or not.

If any of my learned readers have acceſs to Dr Prieſtly's Eſſays, he will there find many experiments made upon this ſubject with a medical view, which may be of much greater uſe to *him*, when conſidered in this light, than they can be of to the phyſician.

I might here mention ſeveral other kinds of bark which are employed for many valuable purpoſes, particularly that of the Canadian *birch-tree*, ſo uſeful for

conſtructing theſe light canoes ſo much employed by the Americans. I might here alſo take notice of the uſe which they make of the bark of the ſame tree in Siberia and other northern countries, for coverings to their houſes, &c.; but as I am but little acquainted with the manner in which theſe are employed, and think that there is little chance of their being much employed in either of theſe ways in Britain, I ſhall not tire the reader by inſiſting any further upon them here.

Perhaps ſome may think, that the ſame excuſe will not be admitted with regard to the *cork-tree*, whoſe bark is of ſuch extenſive uſe, and for which ſuch large ſums of money are ſent out of this country every year. But although it is probable that every tree which can ſurvive the winter-cold in France, will do the ſame in Britain, and that every tree whoſe produce does not depend upon the maturity of its fruit,

fruit, may be cultivated with as great profit here as in France, and that therefore the probability is, that the cork-tree could be raiſed here to advantage; yet leſt ſome ſhould think that I approached too near the regions of romance ſhould I recommend this ſubject to the attention of the ſober part of my countrymen, in order to avoid giving offence, I ſhall not do it, notwithſtanding the favourable opening that the tree in Chelſea garden affords me, which, in ſpite of the daily wounds that it receives, has been preſerved alive for ſuch a great number of years.

* * *

I have thus, Sir, in a curſory manner, pointed out ſome of the principal uſes to which the ſeveral parts of which trees are compoſed may be applied, independent of the value of the wood, that every one who intends

intends to make a plantation may have it in his power to reap every benefit from his trees that the nature of his ſituation will admit of. The value of the wood of each of the different kinds of trees is in general well known to every one in his own particular ſituation, which muſt vary ſo much according to different circumſtances, as to be in ſome places of very great value, and in others of almoſt none at all: but I preſume it would be impoſſible to point out a ſituation where ſome *one* or *more* of the products above mentioned would not render a plantation of trees extremely valuable, and in the end would prove of very great benefit to the country *in general*, as well as of inеſtimable advantage to the proprietor *in particular*; and therefore I muſt once more recommend this ſubject to the ſerious conſideration of every gentleman of property, who wiſhes well to his country or his family. Whether it is

more

more honourable for a man to turn his attention to ſuch rural ſcenes as theſe, which naturally tend to calm the mind, and inſpire it with a peaceful tranquillity; to cheriſh the ſeeds of every virtue, and expand the heart with generous and diſintereſted ſenſations; to make the innocent pleaſures of domeſtic enjoyments be reliſhed as they ought to be by every ſober mind, and to ſecure affluence and independence, and along with it that genuine ſpirit of liberty, its conſtant companion; whether, I ſay, it is more honourable to purſue this plan of life, or to enter into the buſtle of court-intrigues, to ſpend a genteel fortune by dangling after the great, or becoming the deſpicable tools of faction, and ſubject to the nod of ſome mercileſs deſpot, or cringing at the feet of ſome powerful villain, who would have been ſpurned away with horror, as a reptile which deſerved to be trodden under foot,

foot, had the generous ſenſe of a noble independence ſtill kept poſſeſſion of the ſoul.——But I ſtop.—The humane mind would wiſh to draw a curtain over theſe ſcenes of iniquity, and hide them as much as poſſible from the eye of innocence. Such of you, my dear countrymen! who know leaſt about theſe tumultuous ſcenes, I heartily congratulate; long may you continue to enjoy the calm delights which a happy obſcurity, that ſcreens you from the notice of all but thoſe united to you by the tender ties of friendſhip and cordial amity, moſt naturally affords. And if theſe my deſultory ſpeculations can in any way contribute to add to your felicity, I ſhall think myſelf abundantly repaid; or if I could flatter myſelf with the hopes that I might perhaps contribute any thing towards reſtoring eaſe to any one who may be threatened with the fear of want, or preſerving the independence of any family

which

which might be in danger of having their minds enſlaved,—that moſt abject ſtate of ſlavery that can be imagined, it would ever inſpire with the moſt conſtant glow of pleaſure, the breaſt of

AGRICOLA.

P. S. Since writing the above, I examined the following trees, in the method above recommended, excepting that I uſed the bark undried, with a view to diſcover the degree of aſtringency of their bark: *viz.*

1. Oak
2. Birch
3. Broom
4. Beech
5. Rawn-tree
6. Service
7. Lime
8. Laburnum
9. Crab
10. Hornbeam
11. Aſh
12. A green willow, with a leaf reſembling that of the Huntingdon willow.

13. Common hoop-willow, with long narrow leaves, whitiſh on the underſide.
14. Green willow, with ſweet-ſmelling leaves, commonly called *Bay-willow*.
15. Wild branching willow, with a grey bark and round leaves, of a light greyiſh colour.
16. True baſket-oſier
17. Larix
18. Scots fir
19. Silver-fir.
20. Spruce ditto

Their degree of aſtringency, upon trying them, was as under:

1. The *oak*, which ſtruck a deeper tinge than any of them.
2. *Aſh* and *hornbeam*.—Theſe two were nearly equal, and not much inferior to the *oak*.
3. *Green willow*, No. 12. and *bay-leaved* ditto, No. 14.—Theſe were a degree

gree weaker than the former, but very little.

4. *Hoop-willow*, No. 13.
5. *Grey* ditto, No. 15.
6. *Birch.*—The gradations between the *oak* and *birch* were almoſt equal through each of theſe ſteps.
7. *Rawn* or *mountain-aſh*, and *crab* or *apple-tree.*—Very little inferior to the *birch.*
8. *Lime.*
9. *Beech.*—The tincture was now but very ſlight, but ſtill ſufficiently perceptible.
10. *Baſket-oſier*, No. 16. *Larix*, *common fir*, *ſpruce* ditto, *ſilver* ditto, and *broom.*—All of theſe diſcovered a ſmall degree of aſtringency, although but very little.—The two firſt ſhewed rather more than the others.

The *laburnum* did not diſcover the ſmalleſt degree of aſtringency; but

The *ſervice* ſhewed a conſiderable de-

gree thereof; but as the infuſion was very thick, and of a brown colour, I could not know exactly in what part to place it, as I could not compare it with the others; but I think it may be conſidered as equal with the *rawn-tree.*

From this experiment we may draw ſeveral uſeful corollaries.

1*ſt*, As the *birch* bark is found by experience to afford a valuable *tan*, we may conclude, that all thoſe placed above it will afford a more valuable ſtill.

2*dly*, As we ſee, by this experiment, that different ſpecies of *willows* diſcover very different degrees of aſtringency, ſome of them approaching very near to that of the *oak*, while others ſcarce diſcover any at all, it is not impoſſible but that ſome may be found among the great variety of this kind of trees, which may approach ſtill nearer to the nature of the oak than any of thoſe that I had an opportunity of examining; therefore ſuch perſons who have

have a greater variety of theſe, ought to examine each of them with attention. This kind of trees ought to be attended to more particularly than any other, not only becauſe they diſcover a great degree of aſtringency, but alſo becauſe the bark of theſe could be more eaſily procured in conſiderable quantities in any part of the country than that of any other tree whatever. I recommend it to the baſket-makers to cauſe the bark which they peel from their wands be tried by the tanner, as it appears that the hoop-willow, moſt commonly employed for making large baſkets, is poſſeſſed of a great degree of aſtringency, although the ſmalleſt baſket-oſier promiſes to be of little or no uſe at all to the tanner.—But,

3*dly*, I find, ſince writing the above letter, by a memoir among thoſe of the French Academy for the year 1766, that Mr ——— found, that common broom could

could be employed with advantage for tanning leather, and recommends it to his countrymen for that purpoſe, after having made trial thereof. Now, if broom is poſſeſſed of ſo much aſtringency as to be uſeful to the tanner, we may conclude, that the bark of every one of the trees which I examined, except the laburnum, would be ſtill of greater uſe, as they all diſcovered greater degrees of aſtringency, and might therefore be employed on particular occaſions in great emergencies.

Upon the whole, this experiment may ſerve as a guide to the tanner, to enable him to ſelect ſuch trees for the ſubject of his experiments as promiſe beſt to repay his trouble. Perhaps, he may diſcover, that ſome of thoſe which appear equal in this trial, may be more or leſs proper for his purpoſe from ſome properties which they may poſſeſs that I have not attended to. I ſhall only further add with regard

to

to this experiment, that I found, in peeling the branches, that the *birch* yields the thinneſt bark of any: the *oak* does not afford a great deal; the *beech* could never be employed, as it is next to impoſſible to get the bark ſeparated from the tree: the *aſh* affords a large proportion of bark, as do all the ſpecies of *willows*, which is alſo more eaſily ſeparated from the wood than that of any other tree.

After theſe experiments were finiſhed, having recollected, that, when a boy at ſchool, I had frequently eat the young ſhoots of brambles and briers, which I had obſerved to have a very peculiarly aſtringent taſte, I reſolved to try theſe ſubſtances alſo; and having prepared a freſh parcel of oak-bark, I took an equal quantity of the bark of the *bramble*, and another equal quantity of that of the *ſweet-briar*, and having infuſed each of theſe ſeparately, and added to each an equal quantity of

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the ſolution of copperas, I found that both of theſe ſhewed a degree of aſtringency as great as the oak-bark.

But finding that it would be difficult, in large works, to get the bark peeled from the ſhrubs, on account of their prickles, I reſolved to try if they would produce the ſame effect if the pith (for it does not deſerve the name of wood in the young ſhoots) and bark were taken together, as the bark alone; and with this view I bruiſed ſome of the young ſhoots of each of theſe ſhrubs, and cut them ſmall, and infuſed them ſeparately, and upon trial could find no difference between theſe and the bark alone. But that I might be ſtill more certain of this fact, I took ſome ſhoots of the *bramble* which had been ſtripped of their bark, and, upon trial, found that theſe diſcovered as great a degree of aſtringency as either of the others. From the whole of this experiment, then, we

may

may conclude, that the bramble promiſes to be the beſt ſuccedaneum for the bark of the oak, as it is equally good with the ſweet-briar, and could be more eaſily reared; and as the whole of the plant is uſeful, not only the expence attending the preparation of this behoved to be much more inconſiderable than what the preparation of the oak-bark requires, but alſo the quantity produced upon an acre of ground would be annually ſo much greater than could poſſibly be got of the other, that it could be afforded at a much eaſier rate. How much cheaper this might be afforded, it is impoſſible to ſay, without having made the trial; but I am perſuaded that it could not amount to one tenth of the price of oak-bark, as this plant will grow in any ſoil, and, if annually cut, would ſend out ſhoots of ſurpriſing vigour. The effects which ſuch an improvement would produce upon this branch of our manu-

factures need not be pointed out; but they promiſe to be ſo great as at leaſt to claim the attention of all thoſe who may be more immediately concerned in it: and as every tanner has it in his power to procure a ſufficient quantity of this plant for giving it a fair trial, I ſhall think it a reflection upon the ſpirit of my countrymen if none of them attempt it. I myſelf am totally unacquainted with every thing that relates to the practice of this art, elſe I ſhould have ſaved them the trouble of this.

LETTER ELEVENTH.

On the proper Method of pruning Deciduous *Trees.*

SIR, *October* 14. 1773.

HAVING the pen in my hand, I ſhall embrace this opportunity of fulfilling a promiſe I made long ago, of offering a few obſervations on what appears to me the moſt ſucceſsful method of pruning ſuch trees as are not coniferous, when they are intended to be let ſtand for timber: and, to ſave the trouble of repeating a great many particular precepts, I ſhall premiſe a few general obſervations on the growth and œconomy of that particular

ſpecies of plants, by attending to which, any man of judgment and diſcretion will know how to vary his mode of management as circumſtances may require, without being perplexed with caſes and diſtinctions, that it might be difficult, on many occaſions, to diſcriminate or remember.

The leaves of trees are by nature intended to attract the juices of plants from the earth, and to ſerve as organs of perſpiration, by means of which the ſuperfluous juices are thrown off into the air: and as theſe leaves are always found at the extremities of the branches, and as the juices, in flowing to theſe extremities, depoſit in their paſſage that matter which is gradually formed into wood, and ſerves to augment the ſize of the tree, it neceſſarily follows, that as all the juices that flow towards every branch of the tree paſs through the undermoſt part of the ſtem,

ſtem, below the origin of all the branches, that part of the ſtem will be faſter encreaſed in ſize than any other part; for, as every branch carries off from the ſtem, at the place where it diverges from it, all the juices that are pumped up by the leaves upon it, that proportion of the juices can no longer ſerve to augment the ſize of the ſtem above the inſertion of that particular branch. Hence therefore it follows, that the ſtem of the tree will be more or leſs taper, according to the number, ſize, and poſition of the branches.

Now, as it is in general a deſireable thing to have a tree rather to have a ſtem of ſome conſiderable magnitude, than to conſiſt entirely of limbs and branches, it will be prudent in general for the man who has planted trees of this kind, to look over them from time to time, and where he finds any branch that bears too great a proportion to the ſize of the ſtem, inſtantly

ly to lop it off; for it is not with theſe, as with coniferous trees, that, when the leading ſhoot is broke off, ſome one of the lateral branches naturally advances above the reſt,—aſſumes a more erect poſition, and becomes of its own accord the leading ſtem. For, among this claſs of trees, ſhould the above-mentioned accident happen, each of the branches would encreaſe in ſize in proportion to the bulk that it originally bore, till the tree arrived at perfection; every twig continuing to make new ſhoots, and encreaſing in ſize, without neceſſarily pruning itſelf, as the coniferous trees do.

Few who have planted deciduous trees ſeem to have omitted to make this obſervation; and many have drawn a corollary from it that ſeems to be extremely natural, although it leads to an erroneous practice. It is this. Since, ſay they, every branch that ſprings from the ſtem draws

off

off a part of the nouriſhment from thence; and as the ſtem is the principal and moſt valuable part of the tree, it follows, that if all the ſide-branches ſhall be cut off, the whole of the ſap will be determined to the ſtem and top-ſhoot, which will of conſequence advance much faſter than it would otherwiſe do. This, I honeſtly own, was the manner in which I reaſoned in the early part of my life, and practiſed accordingly;—but unfortunately I did not find the effect to anſwer my expectations. The tree, for want of a ſufficient number of leaves, did not pump up ſuch a quantity of juices as it otherwiſe would have done, ſo that the top made no extraordinary progreſs; and as the ſtem, by being thus deprived of the means of being augmented in ſize towards the root, continued too ſmall in proportion to its height; and as the whole of the leaves and new ſhoots were at the top, the wind had ſuch a power over it

as

as to bend and ſtrain it ſo much, as greatly hindered the free aſcent of the ſap, and in a ſhort time made the tree become ſtinted and covered with moſs; and if it chanced to be a quick-growing tree, with flexible branches, like the common Scots elm, the top became too weighty for the ſlender ſtem to be able to ſupport, and it fell down to the ground, ſo as to make the moſt diſtorted and extraordinary appearance that can well be imagined. There is a plantation of elms belonging to a gentleman in my neighbourhood, who has perſiſted in ſtripping all the branches from the ſtem, and leaving only a few at the top, which at this moment has more the appearance of a field covered with large mole-traps, than any thing elſe to which I can liken it.

Being, from theſe obſervations, entirely ſatisfied of the impropriety of that practice, I have ſince obſerved, that, to preſerve

ſerve a tree in the higheſt poſſible degree of health and vigour, it is neceſſary to train it ſo as that the ſtem may have a degree of ſtrength ſufficient to bear, without being too much bent, the wind to which it may be expoſed, and that of conſequence it may be with ſafety more bared in a ſituation that is well ſheltered, than in one that is much expoſed:—that, provided the ſtem can be brought to a proper figure, the greater the quantity of leaves that the tree is allowed to carry, the more luxuriant and healthy it will be; and that, to effectuate theſe purpoſes, the eaſieſt way is, from time to time, to prune away the largeſt branches that ſeem to threaten to take an over-proportion of nouriſhment —to thin the top when too thick, ſo as to let in the air among the branches, without giving the wind too much power over it—and to leave upon the ſtem ſmall branches proportioned to the ſituation

of the tree, and placed in ſuch a manner as the particular ſhape of the ſtem may require; for theſe ſmall branches and the leaves they carry, ſerve to augment the ſtem, and give to the whole tree a degree of vigour that it would not otherwiſe acquire. To thin, then, judiciouſly is the proper province of the pruner, and not to ſtrip the ſtem bare to a certain height, above which nothing at all is done; than which, I will venture to ſay, nothing can be more injudicious, except in a deep vale very much ſheltered from the wind, in which the trees are thinly planted; in which ſituation this practice is far leſs pernicious than in any other.

The reader will eaſily perceive, that, in free ſhooting flexible trees, like the elm, it will be neceſſary to thin the top more, and leave more branches upon the trunk, to bring it to a proper degree of ſtrength,

than

than upon ſuch as grow naturally thicker, as the aſh.

It may not be improper here to obſerve, that the oak, although the natural wood of this country, and happily adapted to our ſoil and climate, has been of late much leſs cultivated than it deſerves, owing to various cauſes, among which injudicious pruning may perhaps be reckoned one. This tree is, in a peculiar manner, the *king of the foreſt*, and is with difficulty reared to perfection in any other ſituation. When young, it advances with great vigour, making every year two ſhoots, one in the month of *June*, and the other commencing in *Auguſt*, which uſually continues to grow till the froſt ſtops it in the end of autumn. This laſt ſhoot is ſometimes of great length; and if the tree is very vigorous, it is ſo ſoft and tender as infallibly to be wholly killed by the froſt; and as a number of ſhoots ſet out next

year at the end of the firſt ſhoot of the foregoing ſummer, it in a ſhort time becomes a thick, buſhy, ſtinted-like ſhrub, which, by continuing long within reach of cattle, is often browſed upon by them, in which caſe it never riſes to any thing elſe than a ſhrub. Now if, with a view to give it a ſtem, we attempt to prune off ſome of the branches, as above recommended, we give it an additional degree of vigour, make it continue to grow later in winter, and of conſequence cauſe it be infallibly killed down almoſt entirely each ſeaſon; whereas, when it grows in the foreſt, although it is in the ſame manner killed down a little at firſt, yet as all the branches that are produced are left upon it, theſe, by being ſo numerous, come at length to loſe that hurtful vigorouſneſs, and thus get time to acquire a proper degree of firmneſs, ſo as to be able to reſiſt the froſt in winter, after which

none

none of them are ever killed down: and as ſome ſtrong ſhoot gradually takes the lead of the reſt, eſpecially if tolerably thick planted, that becomes a ſtem, and in that ſituation it advances ever afterwards without interruption. This is the natural progreſs of the oak; and thus treated, we have few ſoils on which it will not thrive.

I doubt much if it be poſſible to rear the oak to perfection in ſingle rows, or detached trees in an expoſed ſituation; and if ever the pruning-knife can at all be applied to a young oak with propriety, it muſt be by doing it in the month of *Auguſt* or *September;* for, at that time of the year, lopping off any of the branches checks the growth of the tree for that ſeaſon, and gives the tender ſhoots that are left, time to harden before the froſts come on, in which caſe they are not killed down. This I have tried, for the ſake of experiment, ſeveral times, and never found it fail. Many

other

other trees, that are apt to loſe their tops in winter, may be preſerved by the ſame means, or by ſtripping off their leaves at that ſeaſon, as I have likewiſe experienced. Even the aſh-leaved American maple, which, without this care, never fails to be killed down a great way, even in our mildeſt winters, I have preſerved in the ſevereſt winters we have, without loſing an inch, by this means alone.

AGRICOLA.

THE END.

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c/p. with terminal
blank leaf
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